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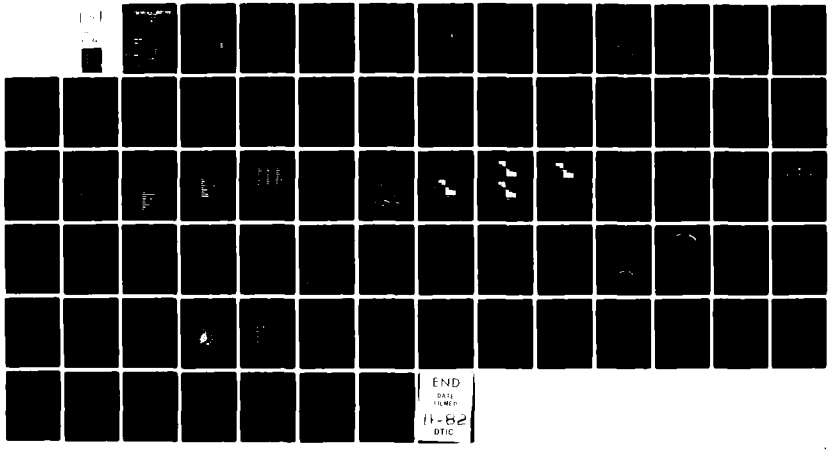

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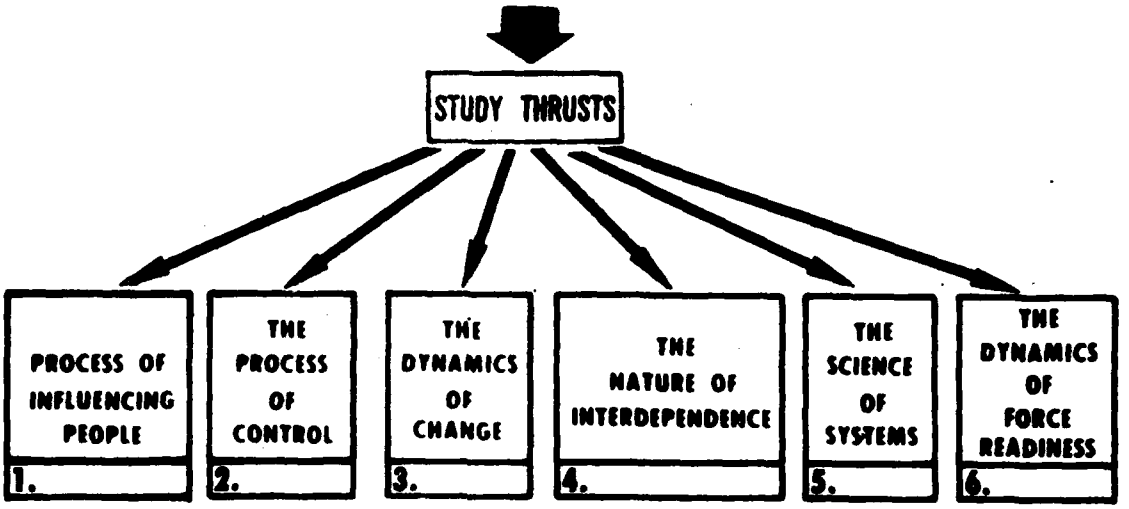
TASK FORCE DELTA – CONCEPT PAPER

PROBLEM STATEMENT

UNDERSTANDING THAT WE MUST WORK THROUGH PEOPLE, HOW CAN OUR ARMY ESTABLISH AND MAINTAIN CONTROL OF CHANGING, INTERDEPENDENT SYSTEMS TO MAXIMIZE FORCE READINESS?



CONCEPT PAPER TITLE: INFORMATION ENGINEERING

CONCEPT: INCREASING OUR ARMY'S FORCE READINESS THROUGH THE IMPROVEMENT IN EFFICIENCY AND EFFECTIVENESS OF HOW OUR ARMY ORGANIZATIONS HANDLE INFORMATION FLOW.

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AUTHOR: LTC WILLIAM W. WITT

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DELEGATION
FORCE READINESS
HIGH PERFORMING SYSTEMS
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LEADERSHIP
ORGANIZATIONAL COMMUNICATIONS
LIVING SYSTEMS
ORGANIZATIONAL CHANGE

20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

This paper explains the critical nature of information flow in organizations using a "Living Systems" model. It calls for new ways to manage information flow with a recognition that the "chain of command" cannot be the sole flow channel if effectiveness is the desired outcome. Also discussed is leadership in the context of "turning information into action."

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INFORMATION ENGINEERING

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INFORMATION ENGINEERING

FIGURES, TABLES AND INCLOSURES

FIGURES:

TABLES:

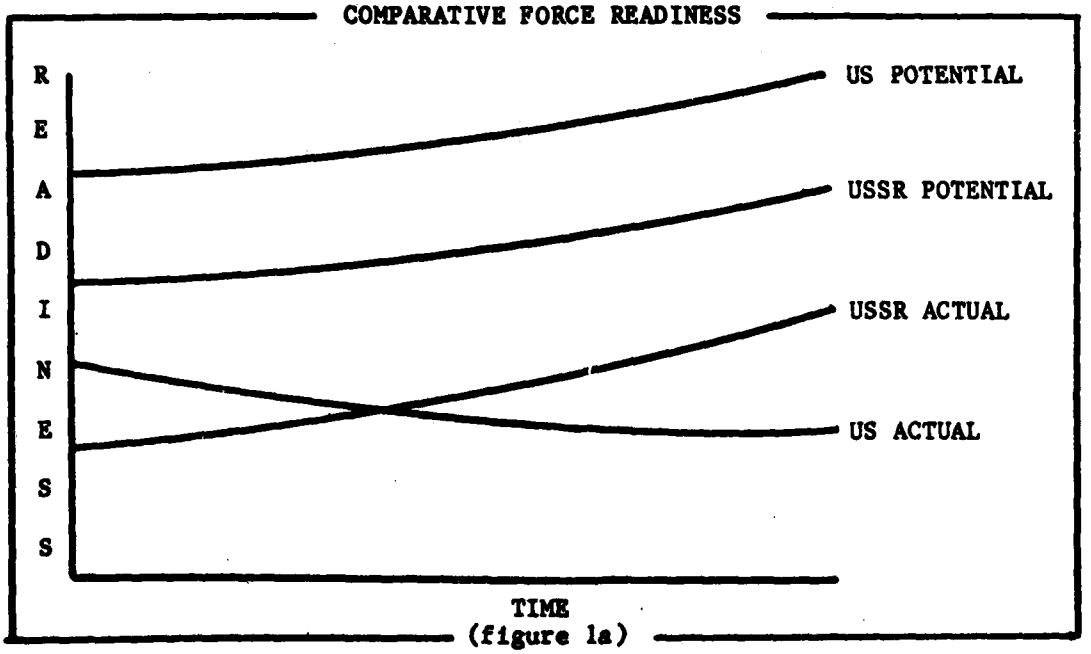
INCLOSURES:

INFORMATION ENGINEERING

TASK

Force readiness is an extremely complex function. There has never been a universally agreed upon measure of force readiness - a list of variables that contribute to Force Readiness would be nearly infinite. Any definitive statement as to how each of the variables contribute qualitatively and quantitatively would be impossible to develop. Since variable definition is obviously a very difficult way to analyze force readiness, discussion on the subject has focused on a mix of objective fact and subjective feel, expressed in generalized concepts such as firepower, state of training, personnel status, etc.

Recently, the question was raised, "How does the way we run our Army organizations contribute to or detract from force readiness?" Answering that question was the task of a TRADOC task force for a two year period. The answer turned out to be H! (H is the symbol for information.) That is, the efficiency and effectiveness of how we run our Army's organizations depends upon the efficiency and effectiveness of how we handle information flow.

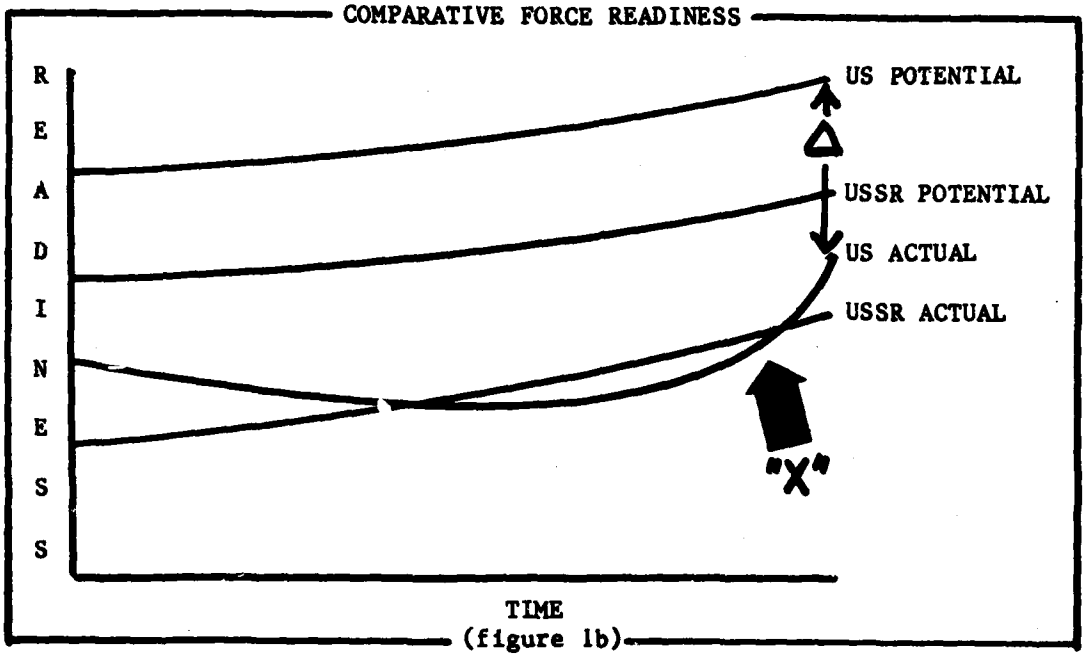


(figure 1a)

INFORMATION FLOW IS A DELTA OPPORTUNITY

Graphically, the situation described is shown in figure 1a. Both nations have an actual readiness posture somewhat below their theoretically achievable potential. In order for the US to surpass the

USSR in actual force readiness, we have to develop a strategy for readiness improvements that will drive us closer to our potential, in other words, reduce the Delta, the difference between our actual and potential force readiness. That strategy consists of a set of mostly unknown factors which have been labeled, "X" and shown graphically in figure 1b.



(figure 1b)

As mentioned, one of the factors of X is "How we run our Army Organizations." What the task force discovered was that the way to more efficiently and effectively run our Army organizations was predicated upon how we handle information flow. That is, X=H. Apparently, the USSR has known this for some time. Current intelligence studies tell us the Soviet Union is putting as much emphasis on information flow as it is on nuclear warfare.

The task therefor, is to increase force readiness through the development of better units by increasing the efficiency and effectiveness of information flow. The conditions under which information flow must be improved include battlefield stress and information overload, both of which are discussed in Chapter II. Chapter III describes the standards which must be acheived in order to gain a delta reduction and Chapter IV outlines a strategy for accomplishing this task.

THE LINK AMONG FORCE READINESS, ORGANIZATIONAL EFFICIENCY AND INDIVIDUAL PRODUCTIVITY

Army units are organizations whose purpose is to be ready to fight. Force readiness will increase as the efficiency and effectiveness of our units increase. Army units are:

- Composed of soldiers
- in order to accomplish a specified mission
- continuously over time
- through a division of labor and responsibility
- integrated by INFORMATION-BASED decision process
- in an environment of stress.

Army organizations come in all types--some large, some small, some dynamic, some stable, some critical, some less critical. But the really interesting and most important distinguishing factor is their relative effectiveness. Why is it that one organization can be totally ineffective, while another organization of comparable size, mission, and circumstance is wholly effective?

The usual answer to that question is "leadership." But there are other important factors which affect the effectiveness of an organization. These include theoretical limitations, when lack of technology exists; resource limitations when money, manpower, or time constraints reduce effectiveness; or organizational limitations which include multiple layering, "turfdom", lack of feedback, debilitating personnel programs, etc. Usually, organizational ineffectiveness is a combination of these factors. The solution, H, to the problem of organizational ineffectiveness primarily addresses organizational limitations.

Improving information flow within organizations is accomplished by the people who process that information. People get information, change it, store it, pass it around, amplify it, and distort it. Improved organizational efficiency eventuates therefor, as a result of how well people process information.

Most everyone has played the parlor game in which the person starting will whisper a word or phrase to the next person. Then the second person will whisper to the third, what he though he heard from the second, and so on until the last person announces what it was he thought he heard. Usually it bears little similarity with the original phrase. But that's just a parlor game.

* * *

1ST AIR CAVALRY DIVISION VIETNAM 1967

ORDER FROM DIVISION TO BRIGADE:
"On no occasion must hamlets be burned down."

ORDER FROM BRIGADE TO BATTALION:
"Do not burn down any hamlets unless you are absolutely convinced the Viet Cong are in them."

ORDER FROM BATTALION TO COMPANY:
"If you think there are Viet Cong in the hamlet, burn it down."

ORDER FROM COMPANY TO TROOPS:
"Burn down the hamlet."

* * *

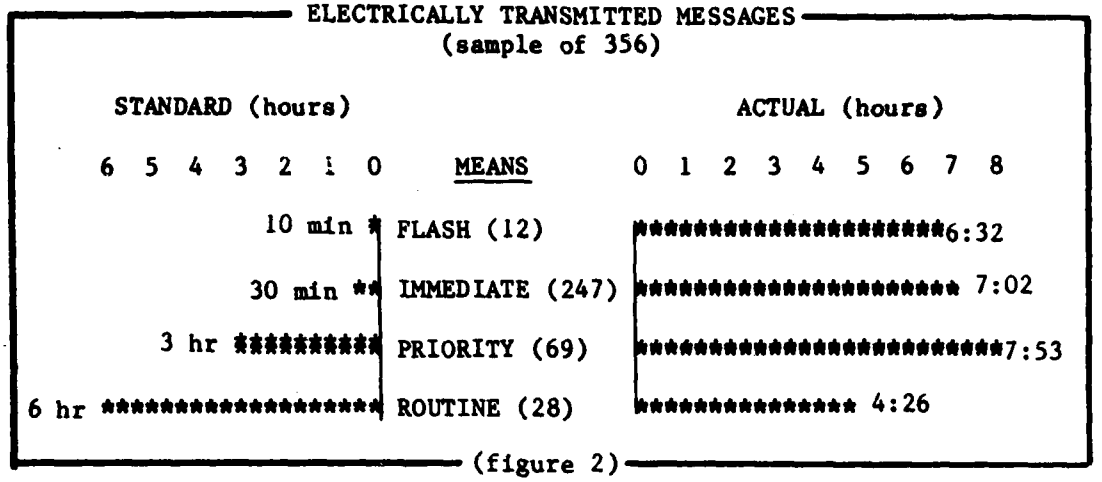
There is obviously more to information flow than the hardware (radios, telephones, typewriters, computers, and switchboards) which has received so much research effort, resources and planning. None of the hardware deals with "meaning" or the "significance" of information. The flash of light signal that Paul Revere got from the Old North Church steeple ("one if by land, two if by sea") represented only one bit (binary digit, the smallest measure of information). But it carried a vast amount of meaning.

None of the hardware mentioned deals with quality measures such as distortion. Information flow as discussed here is beyond the realm of MIS, ADP, and C3I. The lack of attention to the quality factor of information flow has been in large part due to a lack of a conceptual model of information flow that really works.

THE PROBLEM

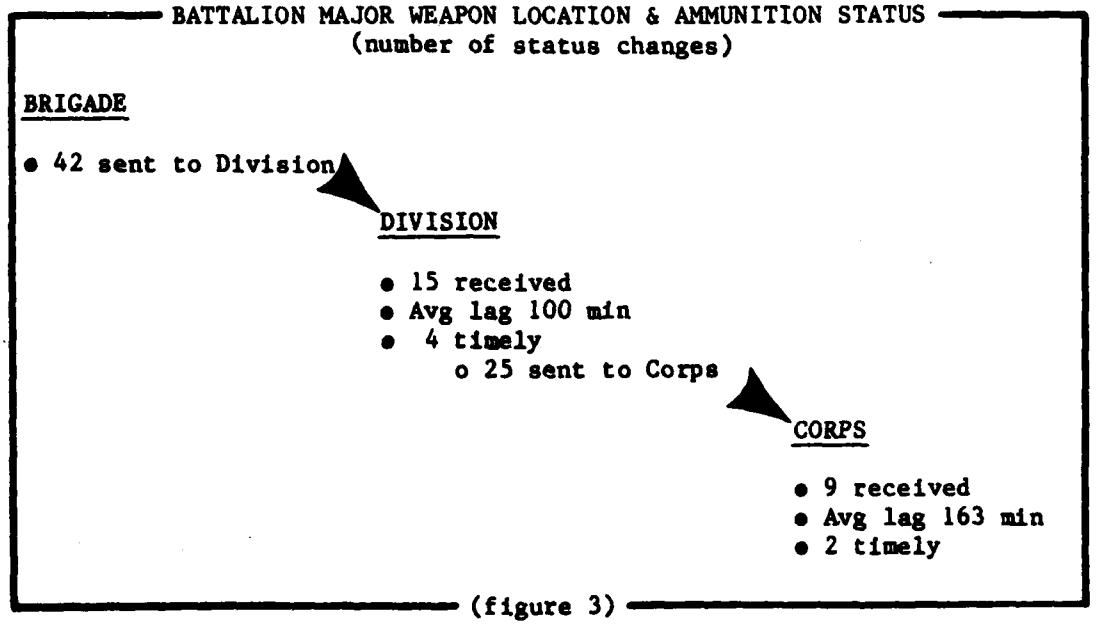
A contemporary aspect of Army organizational environment is scarce resources, among which were mentioned money, manpower and time. In these days of severe budget constraints and energy shortages, there is ironically, one resource that is not scarce--information. Technology has produced a glut of information--more than our organizations want or could possibly use. But the technology that has given us television, communication satellites and lasers together with all the attendant data, has outstripped the organizational ability to process it. The result is the phenomenon of information <u>overload</u>.

<u>Processing information is itself a technology,</u> one that is currently lacking from both a mechanical and conceptual perspective. An example:



(figure 2)

Information flow in a corps was evaluated in a 1979 study. Figure 2 shows that the average time for actual message transmission was far above the design standard. A central conclusion of the study was that, "The biggest inhibitor to effective tactical command and control is communications" and that "the system is overloaded with excess information". Since figure 2 is a quantitative measure of the timeliness of the information flow in that corps in a tactical setting. One can begin to see the problem f ced by corps decision-makers.



(figure 3)

Not only is the timeliness of corps decision-making affected but so also is the quality. Figure 3 shows that much of the important weapons

status data never reached the Corps TOC, the "brain" of the corps decision-making system. Of the 42 status changes sent back by brigade, 64% were not detected at division. The same figure held for division to corps reports. Furthermore, of the 66 brigade reported Artillery battalion location changes, posting at division level was timely and accurate only 11% of the time.

Not shown are the statistics for battalion reports sent to brigade. The study omitted the battalion-brigade interface. It had previously been emperically determined that communications at battalion level were "working comparatively well", giving rise to the question, "What are the information processing capabilities and requirements below brigade level?"

At 1215 hrs on the 6th of February, 1980 an informal study was made of what was going on inside the "brain" of a randomly selected US Army Rifle Company. This unit was in its training phase--preparing for war. In about a month, it was due to move out on a major FTX. It was a good, solid, average, Rifle Company.

The "study" of what the unit was doing was made simply by making a list of what was on the desk tops of the C.O., the XO, and the First Sergeant. In-boxes, out-boxes, notebooks, scraps of paper, official correspondence, and forms. The inventory is in inclosure 1.

All that that list is is a stop-action snapshot of some of the things going on in a unit at a specific moment in time--a hundred pieces of information to be turned into action. It is nowhere near complete. First, and foremost, it does not include all the individual training that's going on, all the time. When the unit fights it needs 1566 individual skills. The school system itself only gives the soldiers about 50-60% of these. The rest are the responsibility of the unit, developed in-the-unit, day-to-day, on-the-job.

Nor does the list include what came down yesterday, and the day before that. Or what's coming tomorrow, and the day after that. And the list only includes what's written down. It doesn't include all the "things to do" that are not written down, but that are in the minds of the C.O., XO, and First Sergeant. Nor does it include the "things to do" that these men have figured out for themselves, without being told by the next higher headquarters. Nor does it include what's coming in over the telephone which, according to the "study", rings just about once every 7 1/2 minutes, usually bringing down more "things to do."

If added to that 100-item list were all the tasks in the minds and notebooks of those three men, and all that's in the minds and notebooks of the rest of the officers and NCOs, the list of what the unit does on an average day of getting ready for war would be in the thousands. How do all those tasks get done? How is all that information processed?

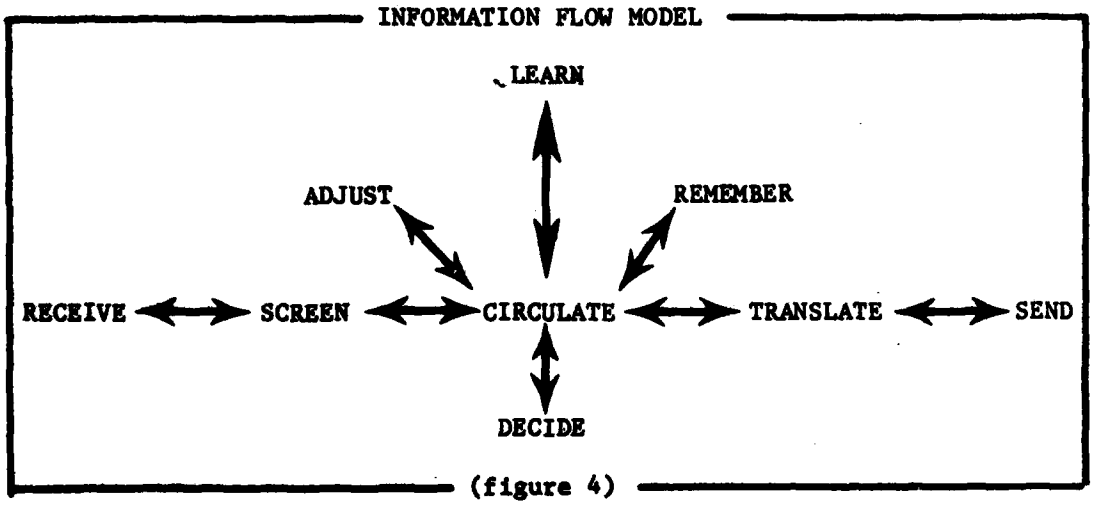
INFORMATION FLOW MODEL

INDIVIDUAL MODE

If an organization is going to efficiently and effectively process the immense quantity of information it uses, it must approach the problem systematically. As with most complex system problems, the use of a conceptual model facilitates defining, working and eventually solving the problem of how this is done.

A reasonable place to start in an investigation of information flow is with ourselves. We, as individuals, process information continuously. In fact, an organization itself does not, in the true sense, process information--the people within that organization, individually, accomplish that task. Organizational information flow then, is the aggregation of individual information flow in the humans in that organization.

You as a human information processor don't consciously take a step by step systematic approach to processing information. Your brain, central nervous system, eyes, ears and muscles all work together in extremely complex relationships which allow you to process information--to sense, learn, decide, remember, talk, gesture, think and show emotion.



(figure 4)

You, just like an organization, can delay, distort, amplify, change and clarify information. A useful model of information flow (See figure 4) will have to account for all of that. Information flows among and between the elements of the model continuously, not sequentially. The model starts with the sensing process and calls it "receive".

RECEIVE

The human receives information through all his sensory organs; eyes, ears, nose, tongue and skin. Through these organs he can input between 3 and 10 million bits of information each second. If you view the human as a system, a living system, you note that quite naturally the sensory organs are close to or on the boundary of the system so that they interface with the system's environment. We use devices to assist the receiving process, devices like radio and telephone receivers, PA systems and contact lenses. When you "see" an enemy soldier, you are receiving.

SCREEN

Receivers pick up "raw" information. Information that must be converted for internal use. To process those 10 million bits of information we receive each second would soon overload our system. We screen the information in order to reduce it to a reasonable amount. We automatically disregard most of the information available to our sensory organs, and pick out that which we need. Your eyes, for instance, screen your visual field so as to differentiate objects from their background in 3 dimensions and in color. Screening tells you the enemy soldier is moving toward your position.

CIRCULATE

That information on the enemy soldier requires activation of the muscles in your body. The central nervous system triggers this response. Information in the form of nerve currents travels quickly into the spinal cord and up through the base of the brain to the higher reaches of the cortex, out again along return tracts to the muscles and glands, triggering the necessary responses. The circulation of information in your body is continuous throughout the information flow process. The circulation network is composed of nerves, glands, vessels, neurons and synapses, all working together to move information, to keep it flowing.

LEARN

Learning is making associations among two or more items of information. You respond as you do to seeing an enemy soldier because you have learned the consequences of an improper response, either through personal experience or training. The learning process includes reading information into and out of memory and comparing information that's received with information already stored in memory.

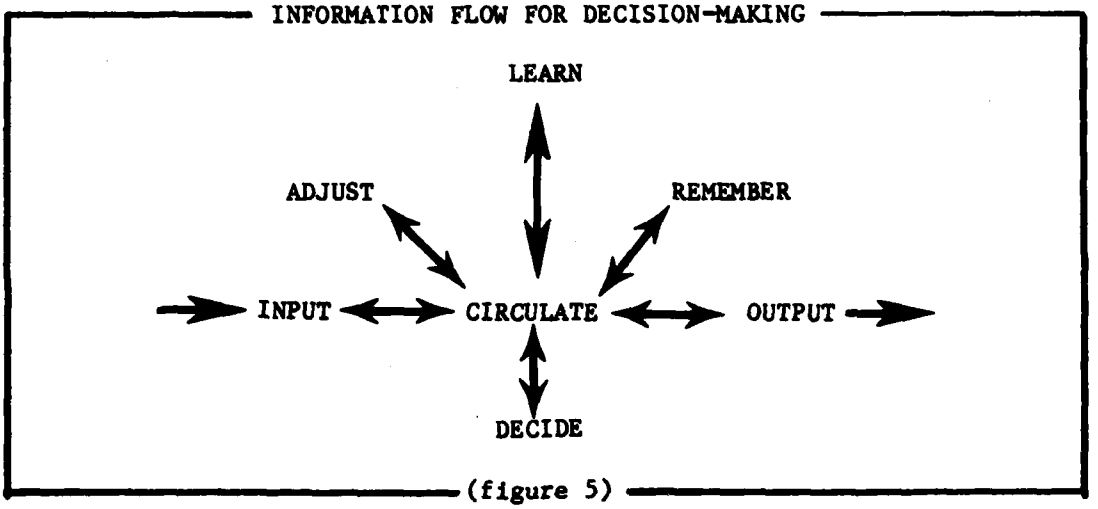
REMEMBER

This is a relatively uncomplex process. It is simply the storage of information to be recalled as needed. The knowledge of what an enemy

soldier is, what he is likely to do, and what you must do in response to seeing him is read out of your memory. Remembering, learning, circulating, screening, and receiving must all work in harmony and therefor must be kept in balance.

ADJUST

Adjusting keeps the information flow in your body in balance. If you are full, adjusting tells you to stop eating. If you hear a loud noise, you cover your ears. If you see an enemy soldier, you engage him. All these actions tend to keep your system in balance. If too much information comes in too quickly, adjusting allows you to cope by one of several methods such as chunking, omission, and queing. Any of these actions require decisions.



(figure 5)

DECIDE

Deciding is the single most critical and complex of your information flow processes. The decider receives information input from all the other processors of your system and transmits to them information inputs that control the entire system. The decision-making process (figure 5) usually involves learning, adjusting, remembering, circulating, and deciding which controls the entire process. Once a decision has been made, it must be formulated for words or action.

TRANSLATE

Feelings, decisions and ideas are formulated for words or actions at the next to last stage of information flow. Just as screening operated on incoming information to ready it for use by the system, translating gets information ready to send it outside the system. Mental images are converted to nerve impulses, ideas are converted to

words and emotions converted to body language. All this information is translated for consumption outside the system.

SEND

The final stage of information flow is the act of passing information across the system's boundary to other systems in its environment. The sending process is usually much slower than the translating process and can be a bottleneck in your information flow process. The form and content of the sending process is of special importance since it is the input to whatever system next receives the information.

ORGANIZATIONAL MODE

The unit, like a human is alive. It has muscles, called soldiers. It has a brain, called the unit CP. And it has, linked to that brain, a nervous system that carries the information that controls and coordinates the muscles. How well the unit fights, how well it can deliver steel, its contribution to force readiness, depends upon the brain, muscles and the nerves. And upon whether they function together as they are supposed to.

The organization mode of the Information Flow model is different from the individual mode only in level. Now, instead of an individual's eyes for sensing and receiving, there are several pairs of eyes. An Infantry Company sends out recon patrols. It sends the 1SG to battalion to gather information. It receives mail and distribution. It receives weather reports, ARTEP missions, Re-up objectives, medical reports, manuals on training, personnel administration, supply and logistics. The list of 100 items from the inventory of the CO, XO and 1SG is some of the information that has been processed by the receiver.

RECEIVING is dispersed throughout the unit. The CO, XO and 1SG though primary receivers, certainly don't account for all of the information received. Each soldier in the unit has the potential and opportunity and responsibility to receive.

But information does not always come free. Certain costs are sometimes incurred. Costs in time and sometimes other resources. Other variables used to measure the quality of information received are meaning (the reduction of uncertainty), distortion and lag. If the information received is complex or if the unit is overloaded, delays in receiving may be critical, particularly when the unit is under stress. Adding more receivers (scouts) may reduce lag, but only if they are efficiently coordinated. These variables will be useful in a later discussion about "What to do if?".

SCREENING is accomplished by organizations in much the same manner as by humans. Receivers commonly screen simultaneously when reporting information they have received. A radar operator reports a blip as an

armor vehicle; the training NCO includes battalion training guidance as he develops the training schedule. Screeners use a variety of aids such as typewriters, computers and statistical tables.

After being received and screened, information continues to CIRCULATE through the nervous system, muscles and brain of the unit. The PAC is a central part of this process; so is the distribution system and the radio/telephone nets. The primary circulating structure is the chain of command.

Information doesn't flow along through a pipe. It is carried by many things--Messages on paper--Runners--Hand and arm signals--Smoke grenades and flares--Radios and telephones--and, most often on the battlefield, men yelling and shouting and calling to each other. This is how the chain of command communicates, how it circulates information flow.

LEARNING by a unit is accomplished by its soldiers. Often, responsibility is dispersed so that each soldier has special responsibilities for learning in a particular field. This division of labor is especially true for staff members who must develop expertise in particular fields. As the soldiers of a unit learn, unit behavior changes. All training is learning.

As soldiers receive, screen, learn and circulate information, balance must be maintained. ADJUSTments must be made to keep the processes coordinated. Channels connecting unit members carry two sorts of information: 1) Information about unit tasks and 2) Information about housekeeping or organizational matters, management of the unit and its members attitudes and feelings. This latter category is the sort of information adjusting uses to keep the system in balance. The XO, CSM and 1SGs are usually specialists in this process.

A unit REMEMBERS through the collective memory of its soldiers together with documentery information contained in its files. Field Manuals, Soldiers Manuals, Commanders Policies, TEC lessons, and the unit bulletin board are all components of its memory. A unit's memory is enhanced through specialization. Organizations can remember much better than individuals by sharing the task (specialization).

Like most of the other processes, DECIDING is dispersed among the soldiers of a unit. Each soldier makes hundreds of decisions every day. Some of those decisions have effect on the entire unit, some only on the soldier himself. And like most of the other processes, deciding has specialists. In the unit these specialists are leaders and are collectively called the chain of command.

Decision making in a unit is the most critical process of information flow. It includes primarily the 5 central processes shown in Figure 5. Deciding and the decision making process is what turns

information into action--it is the vital step that links unit information flow directly to force readiness. THE ESTIMATE OF THE SITUATION is a plan for deciding. THE 5 PARAGRAPH FIELD ORDER is decision for action. TROOP LEADING PROCEDURES are a collection of systematic steps to assist in turning information into action. No unit can continue to survive on the battlefield without efficient and effective deciding.

The unit organization chart and the pyramidal structure that reflects command in that unit is not an accurate description of the deciding process: Like circulating, deciding has informal as well as formal components. As a result of adjusting internal information flows, the distribution of authority and reponsibilities among soldiers may be different from the organizational chart. In some units the commander may decide to exercise tight control all the way down through the pyramid to the bottom of the organization chart. In other units, he may work primarily with only the next level down.

Deciding in a unit means much more than a yes-no, left-right, go-no go decision. Deciding includes the development of purposes, goals and procedures as well as the direction of the unit to implement its purposes and goals. Deciders adjust unit inputs and outputs, set standards, evaluate soldier performance, determine and administer rewards and punishments, develop plans, solve unit organizational problems, resolve interorganizational conflicts and direct the unit's relationships with other units. The decider exercises overall power, being responsible and held accountable for all events in the unit.

The process of TRANSLATING information is accomplished by almost all soldiers of the unit. Methods and types of translating are extremely varied ranging from gestures and facial expressions, translating foreign language documents, to the wearing of uniforms and insignia. Units are eager to establish an identity--an image--with distinguishing characteristics just as individuals develope their own unique personalities. To do this they adopt distinctive insignia, slogans, and behavior. Some become famous thus achieving their intended aim of providing continuity and the ability to survive change.

It is not unusual for translating components to also be components of the decider or sender processes. This occurs, for instance, when the commander of a unit writes and delivers his own operation order.

A unit's relationships with other units and higher HQ are usually carried on by designated soldiers responsible for the SENDING process. Some may speak for the unit on a particular subject (RE-UP NCO), or all subjects (commander) and in a particular or all situations. Most units use strict formal control when sending up while sending to subordinate units is less strictly controlled.

This unit mode of the Information Flow Model is not different in

concept from the soldier mode. Information is the basic raw material of any unit and the soldiers in that unit can be viewed as information processors. The same processes are present and serve the same function. The structure is different to take account for the interrelationships among the components (soldiers) of the unit. By keeping this mental picture of information flow in mind, one can systematically investigate the flow of information in any unit or organization and apply the concepts and tools which will be discussed later. This is the information processing technology needed for efficient and effective information flow.

The size of the unit being investigated is immaterial to this model. It holds for a squad or fire team as well as for the Department of the Army and all levels of units in between. Table 1, Examples of Organizational Information, is a list of types of information as they flow through the model at various levels.

EXAMPLES OF ORGANIZATIONAL INFORMATION

RECEIVE

1. S3 gets OPORD from Brigade HQ.
2. A "blip" appears on a forward deployed radar screen.
3. A FIST FO sends in call for fire to BN FDC.
4. A Senator asks Congressional Liaison Office for data on the All Volunteer Army.

SCREEN

1. S3 extracts Bn portion of Bde OPORD
2. Radar operator deciphers blip as armor vehicle.
3. FDC converts call for fire data to gun data.
4. Congressional Liaison Officer stamps inquiry "urgent".

CIRCULATE

1. Bn Cdr passes out Cdr's guidance on OPORD to Bn staff.
2. Radar operator calls radar sighting to S2.
3. FDC calls gun data to guns.
4. CLO sends inquiry to DCSPER for response.

LEARN

1. S3 Air discovers that air support assets are fully comitted.
2. S2 notes that no friendly units are in area of radar sighting, concludes that vehicle is enemy.
3. FSCoord checks call for fire coordinates, notes that it is location of FO who made call for fire.
4. Action Officer observes that data asked for was prepared for earlier response last week.

ADJUST

1. Bn Cdr tells S3 to keep the Scout Platoon in reserve to give them some rest.
2. S2 orders all radar operators to reorient their principal sector of scan to new azimuth.
3. FSCoord sends check-fire to FDC.
4. Division Chief tells action officer to coordinate response with OSA.

REMEMBER

1. S3 Air consults air movement SOP.
2. S2 looks up movement data on BMP.
3. FDC records call for fire coordinates on map.
4. DCSPER action officer uses his directory to look up address for congressman.

TRANSLATE

1. S3 writes Bn OPORD.
2. S2 prepares spot report on radar sighting.
3. Arty Bn Cdr develops land navigation tng program.
4. Congressional inquiry response is typed.

SEND

1. Bn OPORD is issued to rifle companies.
2. S2 spot report is transmitted to Bde HQ.
3. FOs receive land navigation refresher training.
4. Congressional response is delivered to congressman.

(table 1)

CONDITIONS

BATTLEFIELD STRESS AND DECISION MAKING

INDIVIDUAL LEVEL

The battlefield is the most honest place in the world. Lies on the battlefield are punished not with gossip but with action. "Sirs" and salutes and deference things are not important. Information flow--the communication of fact, (and affect as well)--must be clean, simple, whole and accurate. The efficiency and effectiveness of information flow on the battlefield is what determines the quality of combat decisions. And the quality of combat decisions is what determines the outcome of the battle.

Decisions on the battlefield are characterized first and foremost, by their importance. The lives of individuals, units and nations are at stake. That knowledge creates stress. The battlefield itself, with the danger, noise, uncertainty, loss of life, fear, and drastically altered situations changing at an extremely rapid rate, all add to an environment of stress.

There is no opting out. Decisions must be made--accurately and rapidly. In a typical combat situation, a Company Team Commander must make major decisions at the rate of one each minute for the first 20 minutes of battle (See Table 2). The decision making rate doubles for the Battalion Commander who will be making 11 decisions (2 per minute) in the last 5 minutes of the first 20 minutes of battle. These decisions are made amidst the smoke, noise confusion and uncertainty of battle.

MAJOR DECISIONS MADE BY TEAM LEADERS AND BATTALION COMMANDER

SITUATION: Battalion Task Force under attack by enemy forces. Major decisions include; positioning of units, positioning of TOWs, detecting enemy presence and opening fire on enemy targets.

	MINUTES INTO BATTLE		
	10	15	20
Team A	4	12	18
Team B	4	12	17
Team C	2	10	18
Bn Cdr	7	11	22

(table 2)

How can organizations maintain an efficient and effective information flow in such an oppresive environment? The answer to that

lies, as before, in the behavior of the people within the organization. And to find out how organizations can produce sound decisions under stress we will investigate the individual's response to stress, especially as it relates to the way in which he processes information.

Today, widely accepted ideas about stress are being challenged by new research. Scientists are studying the stress of normal day-to-day existence as well as episodes of the kind of extreme stress found on the battlefield. They are measuring both the temporary and permanent effects of stress upon the human body. And they are seeking practical ways of coping with stress, of avoiding or minimizing its negative effects and exploiting its good ones.

There are three related but distinguishable types of stress: emotional, physiological and behavioral. The most obvious is emotional stress; one pales with fear, reddens with rage, blushes with embarrassment, retches in revulsion, weeps in sorrow and laughs with pleasure. Emotional responses are meaningful, but difficult to measure.

Physiological response to stress leads to bodily change, sometimes so severe as to lead to disease--stress can be the cause of headaches, backaches, ulcers and heart disease.

The most significant response to stress as it affects the flow of information is behavioral change. Behavioral change as a result of stress can be guaged by changes in performance. Stress in moderate doses will usually improve performance. But battlefield stress does not usually come in moderate doses. To cope, we need to understand what happens to us individually and then what happens to our organizations as they process information under stress.

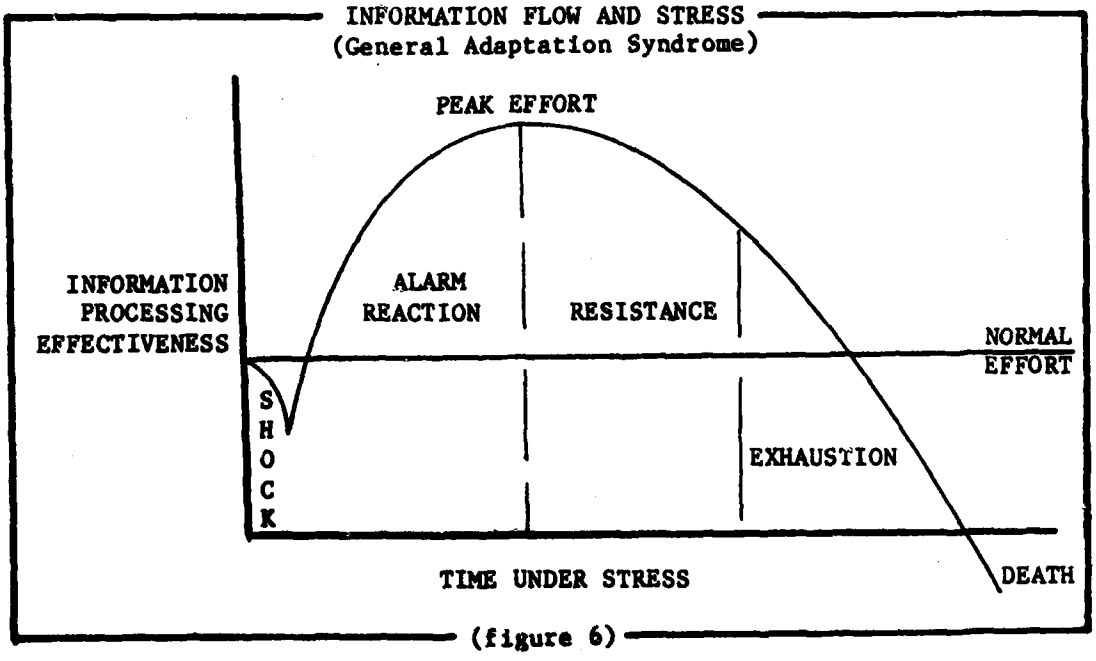
Stress response begins in the very center of the brain, in the hypothalamus, a complex bundle of nerve cells that regulates growth, sex and reproduction. No bigger than the tip of a thumb, the hypothalamus controls both the autonomic nervous system which regulates the "automatic" activities of the body's organs and the pituitary gland which releases hormones. Together they direct the functioning of every part of the body.

When that first enemy round snaps overhead, an instantaneous shock hits the body system. Then muscles tense and tighten. Breathing becomes deeper and faster, the heart rate rises, blood vessels constrict, face muscles contort, those of the nostrils and throat force passages wide open. The stomach and intestines temporarily halt digestion while the bowel and bladder muscles loosen. Perspiration increases, saliva and mucus secretion decreases. The adrenal glands dump epinephrine and norepinephrine into the blood stream, producing both fear and rage.

All these signals, conveyed by the nerve impulses and chemical

surges, put your body in fighting trim, ready to meet a physical threat. The body is prepared for quick decisions, vigorous action, "superhuman" effort, and defense against injury. Hearing and smelling become more acute. Faster breathing brings in more oxygen. Open nose and throat passages permit easier airflow. The increased heart rate pumps extra blood with richer loads of oxygen to the brain and muscles. Blood clotting time shortens and wastes, the "cold sweat of fear", are evaporated to cool the body.

These actions and reactions are the immediate responses to stress. They are the "alarm reactions". But this response is only the first of three stages. In the second stage, the "stage of resistance", functions return to normal and resistance to further stimuli rises. The third and final "stage of exhaustion", may occur if severe stress continues. The reserves are burned up. The symptoms of the "alarm reaction" reappear, this time irreversibly, and death may follow. These three stages form the "General Adaptation Syndrome" (figure 6) which depicts response over time and is accurate for units as well as individuals. The military implications are obvious.



(figure 6)

Israeli studies in their '73 war showed that stress casualties occured with about the same frequency as losses from wounded in action. In World War II, combat veterans of 4 Central/South Pacific amphibious Assault Divisions reported experiencing the symptoms of stress on the battlefield listed in table 3.

BATTLEFIELD STRESS SYMPTOMS

SYMPTOM	PERCENT REPORTING OCCURENCE
Violent pounding of heart	76 %
Sinking feeling in stomach	63 %
Shaking and trembling	52 %
Nausea	48 %
Cold sweat	46 %
Feeling weak and faint	41 %
Muscular stiffness	41 %
Vomiting	19 %
Losing bowel control	11 %
Urinating in pants	7 %

(table 3)

ORGANIZATIONAL LEVEL

The conditions under which Army organizations must increase the effectiveness and efficiency of information flow are dictated by the battlefield. Units and individuals must operate under conditions of extreme battlefield stress. The disruption of information flow will be specifically targeted by the enemy. He will dedicate effort toward electronic warfare, psychological warfare, imitation and deception--all in an effort to interrupt, impair and destroy our information flow and hence, decision-making capability.

Two major aspects of unit combat functioning will be covered here--information flow and decision-making. Decision-making involves the consideration of alternatives, setting standards, deciding on methods and procedures, etc. Decision-making will be viewed in an environment of uncertainty. The very notion of the battlefield implies uncertainty. In this context of uncertainty, units and their Commanders have to make decisions as to the allocation of resources for mission accomplishment.

In general, organizational decision-making on the battlefield has several characteristics which distinguish it from "routine" decision-making. Both the rate of decision making and the number of decisions made increase, as pointed out by table 2. The increase in the number of decisions is initially most marked at the lower levels of the organization. This makes the decision making process more diffuse on the battlefield. There is less consultation among members of the organization before they act, meaning that individual autonomy is greater than usual. Organizations themselves commonly use "new" coordinating arrangements made ad hoc to fit the "new" situation.

In general, information flow provides the context for battlefield decisions. The content of information flow is affected on the battlefield by numerous variables. For example, relevance or priority; volume or amount; lag; distortion; mode of processing; simultaneousness; redundancy; accuracy; vagueness; confusion and intended audience--all assume significant importance on the battlefield. In general, social rather than technological factors determine the state of information flow effectiveness. The corps study mentioned earlier found that the key to command and control was not technology but people and procedures aided by technology. Technological advances only increase the volume, and not the accuracy of information, and hence, increase the need for coordination and integration of information flow.

The information flow task of Army organizations on the battlefield is carried out by humans--humans subject to the stress reactions already discussed. Humans must make the important battlefield decisions required for the unit to survive and prevail. Decision-making under stress is not only critical but extremely difficult. Strategies for overcoming these difficulties will be outlined in Chapter IV.

During certain periods of extreme stress, our communications system has shown itself vulnerable to pressure. In June of 1967 the USS Liberty was attacked by Israeli forces. Thirty-four crewmen died, and many others were wounded. The notable feature of this incident was that the Joint Chiefs of Staff had ordered the ship to move farther from the coast because of the increased tension in the area, but "The message was misrouted, delayed and not received until after the attack" (according to a summary of the court of inquiry findings which were released on 28 June 1967). This finding has a familiar ring to it. Incidently, the Liberty was a communications relay ship.

Information flow and decision-making under stress have been the subject of very detailed and comprehensive research. The Disaster Research Center at Ohio State University systematically studied behavior and response in actual disasters. Their report was derived from the study of more than 100 actual disasters over a period of seven years. From this research a list of findings has been developed which describe the effect of battlefield stress on information flow and decision-making. These findings are contained in inclosure 2.

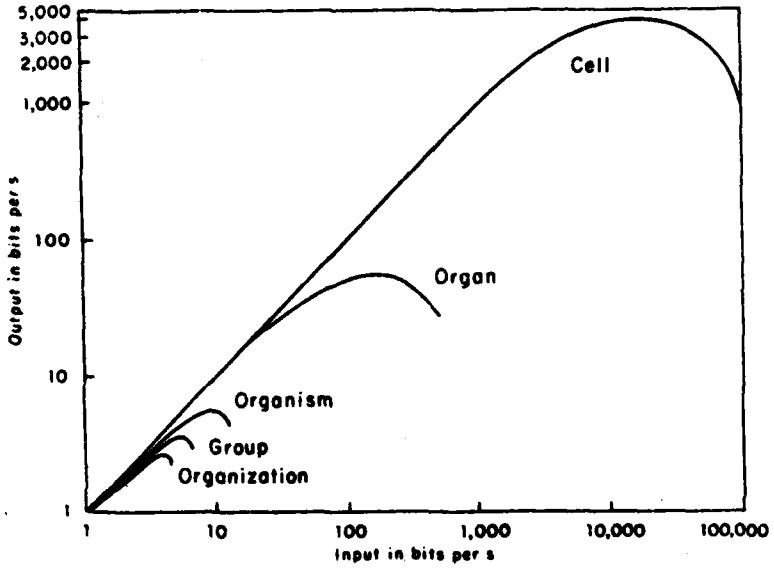
INFORMATION OVERLOAD

As information inputs impinge more and more rapidly on a unit, they eventually overload its capacity to process information. Ultimate breakdown of efficient information flow occurs.

As information input--measured in bits per second--increases, information output increases almost identically at first. But gradually, output falls behind as it approaches a maximum possible output rate. Finally, as the information input rate continues to

increase, output decreases gradually toward zero and breakdown. Figure 7 shows the relationship between input and output at various levels of living systems. As the level increases in size and complexity, the ability to accept input and produce output is diminished.

INFORMATION INPUT OVERLOAD



(figure 7)

To cope with input overload, an information flow system, such as an Army unit, uses several adjustment processes. Adjustment processes enable units to maintain stable input/output rates. The magnitude of the adjustment processes rise as information input (receiving) rates increase up to and somewhat beyond the capacity of the unit. These adjustments enable the output rate to remain at or near the information flow capacity of the unit, and then to decline gradually, rather than fall steeply to zero. Among the limited number of adjustment processes which units employ as input rate increases are:

- Omission - failing to transmit some information
- Error - incorrectly transmitting information
- Queing - temporarily delaying the transmission of some information
- Filtering - giving priority to some information
- Abstracting - transmitting information with less than complete detail
- Multiple Channeling - simultaneously transmitting information over two or more channels
- Escape - acting to cut off information input
- Chunking - consolodating information into organized "chunks" rather than transmitting raw input

Each of these methods of adjustments has costs, measured in time, matter, energy consumed, or loss of reward. An example of cost for adjusting process is found in a US Army Signal Corps incident in 1941. The office that decoded and translated radio messages from Japan was so overloaded that it had heavy backlogs (queing). Consequently, when two messages were intercepted, they were not processed until middle or late December. One, from Tokyo to Honolulu, said: "In view of the present situation, the presence in port of warships, airplane carriers and cruisers is of utmost importance. Hereafter, to the utmost of your ability, let me know day by day. Wire me in each case whether or not there are any observation balloons above Pearl Harbor or if there are any indications that they will be sent up. Also advise me whether or not the warships are provided with anti-mine nets."

The other message concerned light signals to be flashed from a house on Lanakai Beach in order to reveal movements and anchorages of the US Pacific Fleet. By the time these two messages were processed, the Japanese had attacked Pearl Harbor.

The "ideal" communication climate in the "high performing unit" may not look like finely tuned machinery, but rather like a constantly changing, somewhat unpredictable operation. The best units always display varying proportions of what seems like disorder and chaos, when operating under conditions of battlefield stress and information overload. What these high performing units are doing is coping with three basic but not necessarily compatible objectives--adaptability, stability, and productivity.

In its efforts to be <u>adaptable</u> to battlefield conditions, units tend to make coping an end in itself, rather than a means to continued productivity--the delivery of steel. In search of <u>stability</u>, prescriptions are given to clarify lines of authority and to make certain communication follows "approved" channels. This strategy is pursued because of the misperception that adequate information flow on the battlefield is gained by making organizational structure more rigid and precise and is in direct conflict with efforts to adapt.

<u>Productivity</u> must be recognized as the dominant objective, and must be continually measured against some predetermined norm or <u>standard</u> in order that adaptivity and stability remain in perspective. Productivity measured against a standard will keep unit effort "focused".

STANDARD

INFORMATION FLOW IN HIGH PERFORMING SYSTEMS

Most of us, at one time or another in our Army careers, have been part of what we might call an outstanding or "high performing" unit. If asked to define why that particular unit was high performing, what caused it to be an outstanding unit, most of us would have to struggle for an answer. We may say something like, "There was a rhythm of operation in that unit that was felt by all its soldiers and evident to other units. Those soldiers ate, slept, breathed and fought for that unit. They really had it together". That unit is probably the STANDARD against which you measure all units.

A standard is a statement of how well a task must be performed, regardless of the cost, time, environment, or safety hazards involved in performing the task. The task standard in the case of information flow is not used to actually measure task performance. However, information flow standards form the basis for whatever job performance measures can be established. A standard refers to the acceptable quality of information flow processing in the real-world battlefield environment. Process standards generally are described in terms of sequence, completeness, accuracy, speed of performance, etc. The process performance standard for information flow will be described in terms of cost, lag, distortion, volume and meaning.

We can sense to some degree when information is being handled well or poorly. But there is no known method for quantifying exactly an effectiveness measure for handling information. Look back at your experience in that high performing unit and ask yourself this question, "Could it have had to do with the way information flowed in that unit?" Probably, that unit was outstanding because of its level of efficiency and effectiveness of how information was used to run that unit, to organize its matter-energy, to turn information into action.

At present, the best we can do is observe and then decide whether a unit "has got it all together" or not--the intuitive feel that seasoned commanders have. They sense/feel when a unit is high performing. That in itself may be a difficult task. Some recent work on High Performing Systems by organizational/managerial experts has resulted in a list of indicators of High Performing Units (see inclosure 3).

An Army led research team at the University of Louisville has recently completed the first half of a research project which has investigated information flow in Tank Battalions. The purpose of this research is to relate information flow to unit effectiveness. The model used in that research effort was similar to our model of information flow, and the findings from that research form the basis for a standard for information flow in Army units.

From theoretical physics comes the revelation:

ANYTHING AND EVERYTHING IS NOTHING MORE
THAN
MATTER-ENERGY, ORGANIZED BY INFORMATION

Almost all organizational research has dealt with the treatment of the matter-energy half of the above equation. The University of Louisville research dealt with the "organized by information" half. It is a "bridging of the gap" between the scientific process of INFORMATION ENGINEERING and things that soldiers can understand and do. It is not ready for the soldier yet. Further research and "greening" are still underway. But the leadership, policy makers, and developers of our Army's future direction need to know, now, that the essence of force readiness is inextricably linked to how our Army processes information. It is man's information processing capabilities that make him a dynamic, adaptive and creative being. While matter-energy is the building block of man as an organism, it is information and its processing that are the essence of man as part of an organization.

The Army, through this research, has developed a methodology for measuring the performance of the elements in the IF model. This is done by measuring the variables--lag, distortion, cost, volume and meaning--variables that underlie many of our Army's "communications problems". In effect, the research was a "TI" of the information flow in a major combat unit ...and therein lie powerful implications for defining a standard for processing information.

The objectives of the research were to describe information flow elements ("Receive", "Screen" etc) and their interactions and then to relate those findings to the development and maintenance of unit effectiveness. The research was limited in scope to information dealing with training management.

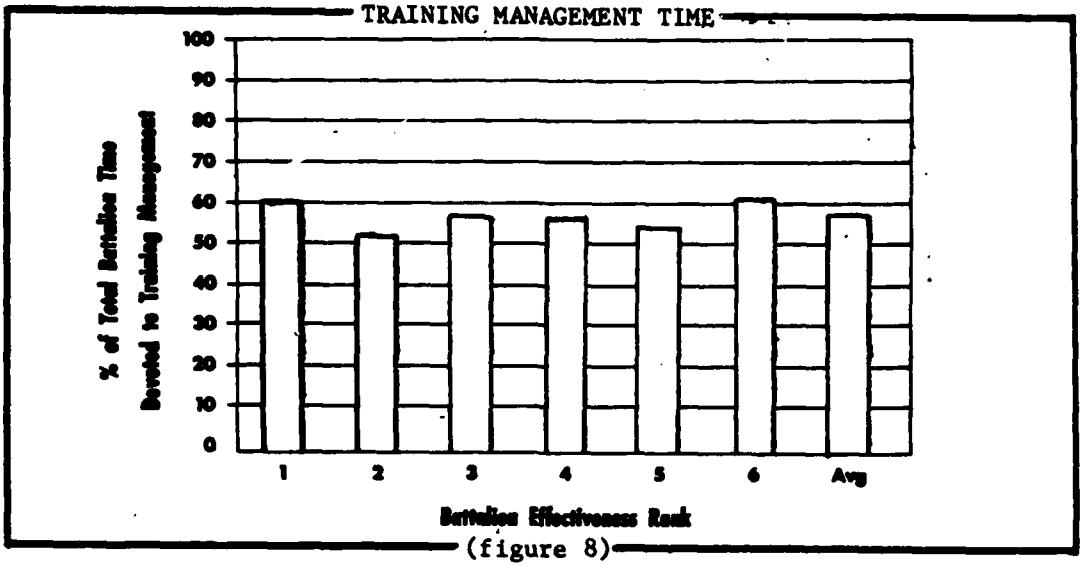
Six U.S. Army Armor Battalions, four in the continental United States and two in Europe, were studied. 841 soldiers were included in the research sample. Thus, a comprehensive picture of information flow was obtained.

The variables used to measure information flow within these Armor Battalions were:

- Meaning (relevance/usefulness/amount of contribution)
- Lag (timeliness)
- Cost (time in manhours/% of effort)
- Distortion (change)
- Volume (amount/number/frequency)

Effectiveness data was collected so that the battalions could be rank ordered according to unit effectiveness as measured by command and performance indicators as well as traditional operational data.

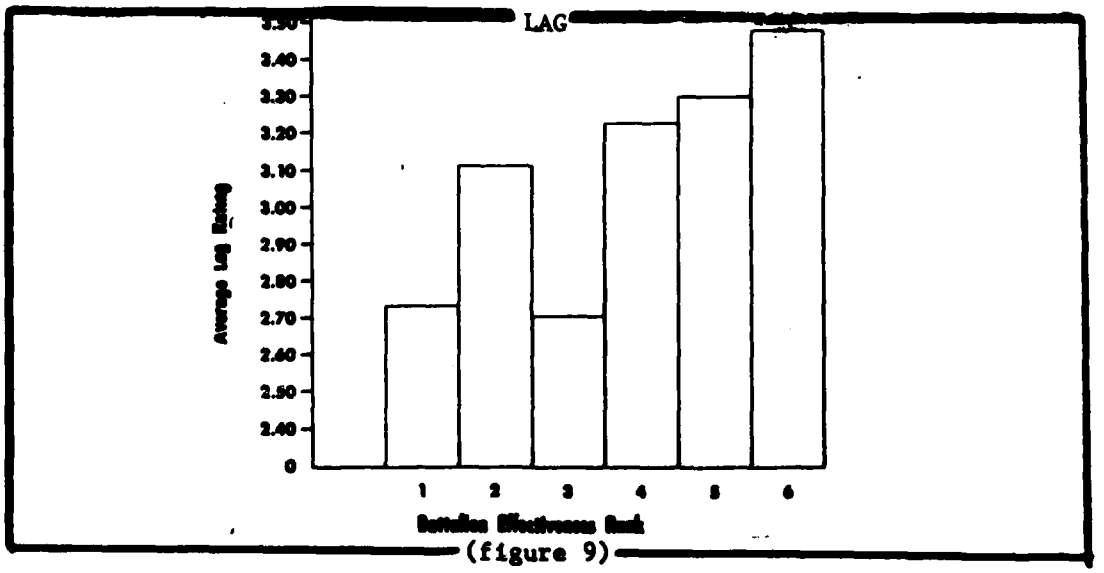
Research findings showed that the quantity of information flow did not correlate with unit effectivensss as shown in figure 8.



(figure 8)

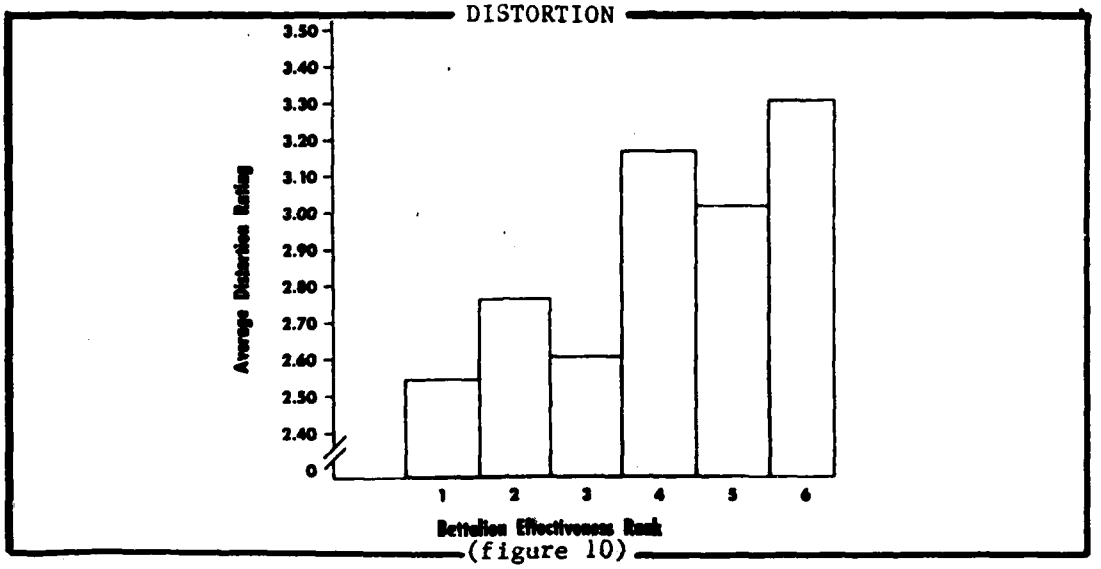
All battalions devoted approximately half their time to training management related information flow. Thus IT IS NOT THE AMOUNT OF INFORMATION FLOW PROCESSED, BUT RATHER THE MANNER IN WHICH IT IS PROCESSED THAT SEPARATES EFFECTIVE FROM LESS EFFECTIVE UNITS.

The problem of information timeliness for commanders at all levels of the chain of command was discussed earlier (figure 2). The research showed that there was a direct relationship between how timely a unit processed information and that unit's effectiveness as shown in figure 9.

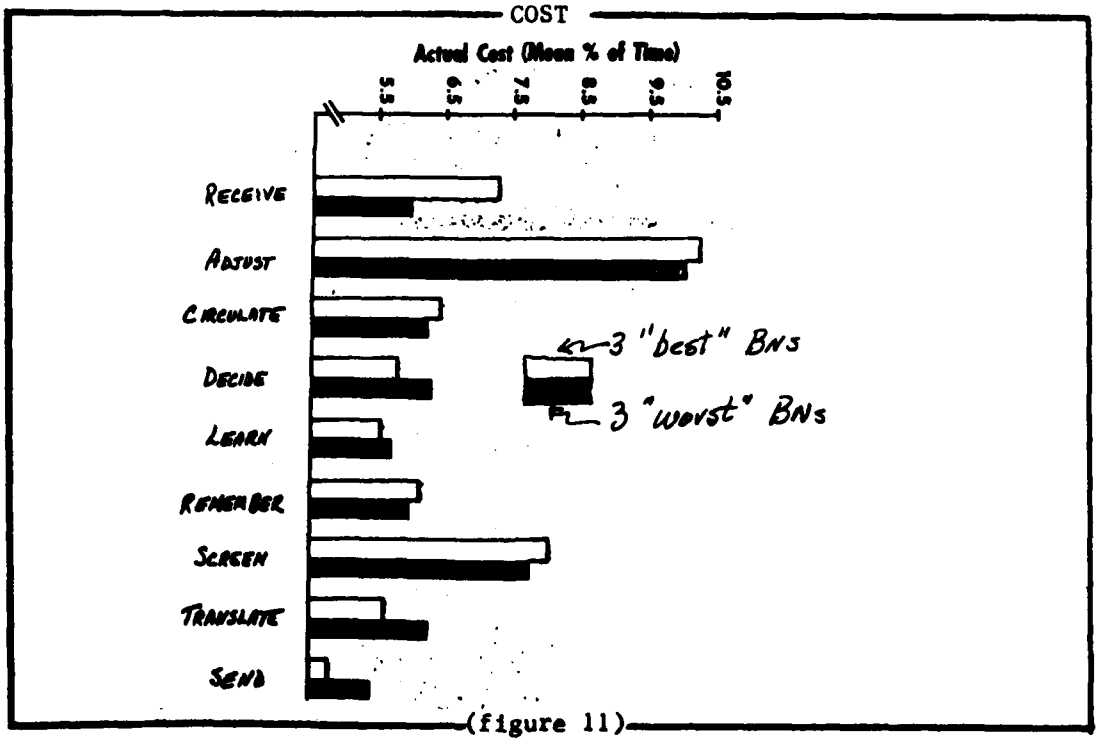


(figure 9)

The same sort of relationship held true for distortion. That is, THE HIGHER THE DISTORTION OF INFORMATION IN UNITS, THE LOWER WAS THEIR RELATIVE EFFECTIVENESS (See Figure 10). Lag was most related to effectiveness in deciding, learning, screening and translating.



(figure 10)

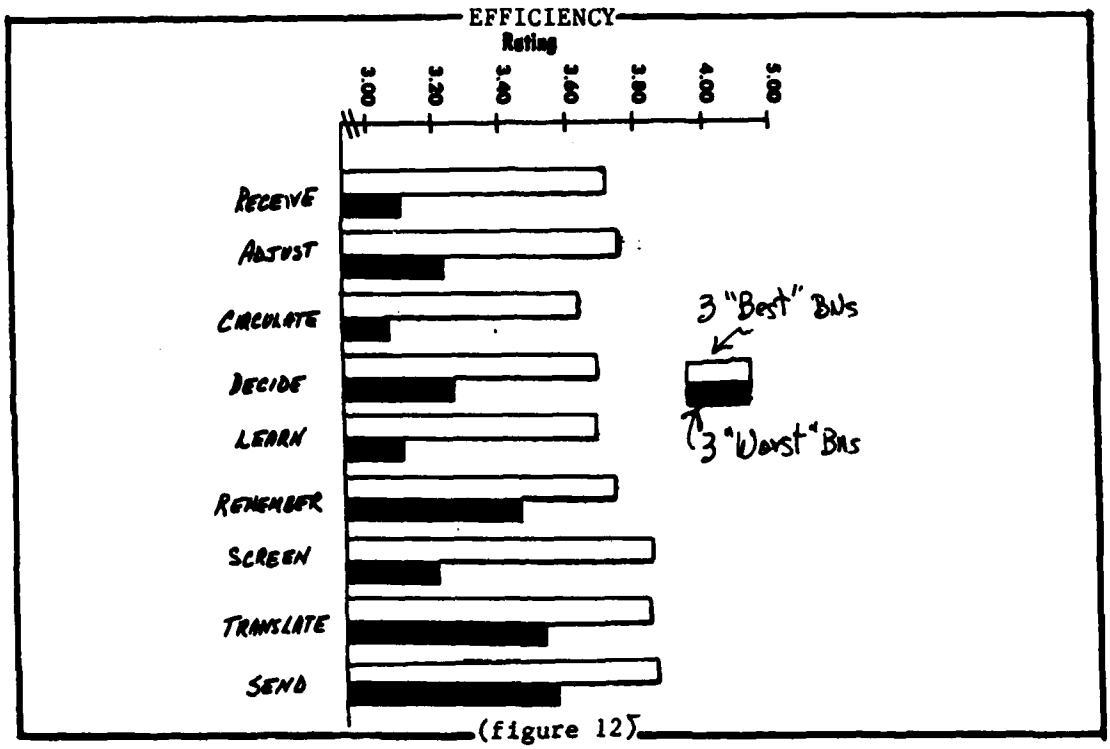


(figure 11)

Since quality rather than quantity of information flow was found to be the discriminator between more and less effective units, side by side comparisons of each of the elements in the information flow model were

made. The best three units were compared with the worst three for each of the model elements. Figure 11 shows that THE BETTER UNITS SPENT CONSIDERABLY MORE TIME RECEIVING AND LESS TIME IN SENDING. All six units spent the most time in adjusting and deciding.

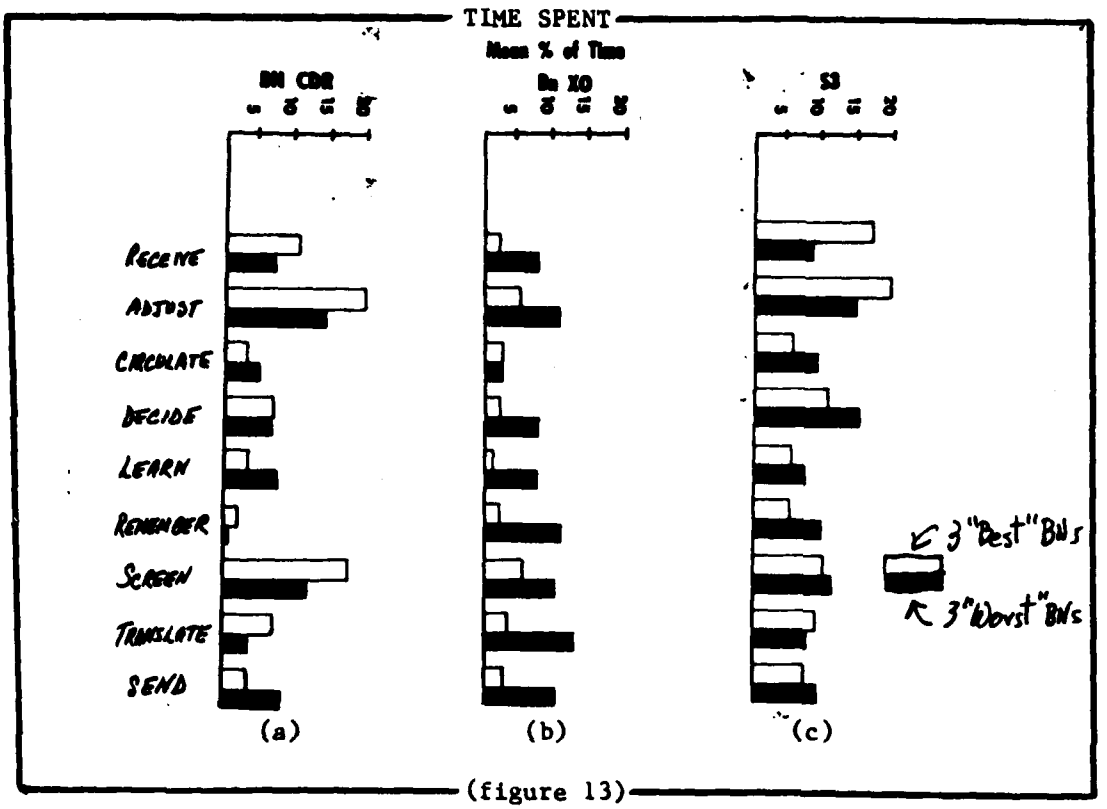
Unit soldiers were asked to rate the efficiency of each of the elements in the IF Model. (A detailed description and explanation of the model elements was given each respondent). As shown in figure 12, INFORMATION FLOW WAS CONSISTENTLY MORE EFFICIENT IN THE BETTER BATTALIONS.



(figure 12)

An investigation of who was doing what with training management information flow showed that in the more effective battalions, Battalion commanders spend about 75% of the total day processing training management information, while Commanders of less effective battalions spent about 65%. A comparison of how the two groups divided their time among the various elements of the IF model is shown in figure 13(a).

Commanders of the more effective units are monitoring and supervising unit activities (adjusting) and turning information into action (deciding). IN THE LESS EFFECTIVE UNITS, COMMANDERS ARE CONCENTRATING ON OUTPUTTING INFORMATION (SENDING). The profiles for Company Commanders parallel closely the profile for Battalion Commanders. Figures 13(b) and (c) show profiles for the Battalion XO and S3. Note that in the more effective battalions, XOs spend relatively little time processing training management information. The S3 profile parallels that of the Battalion Commander.



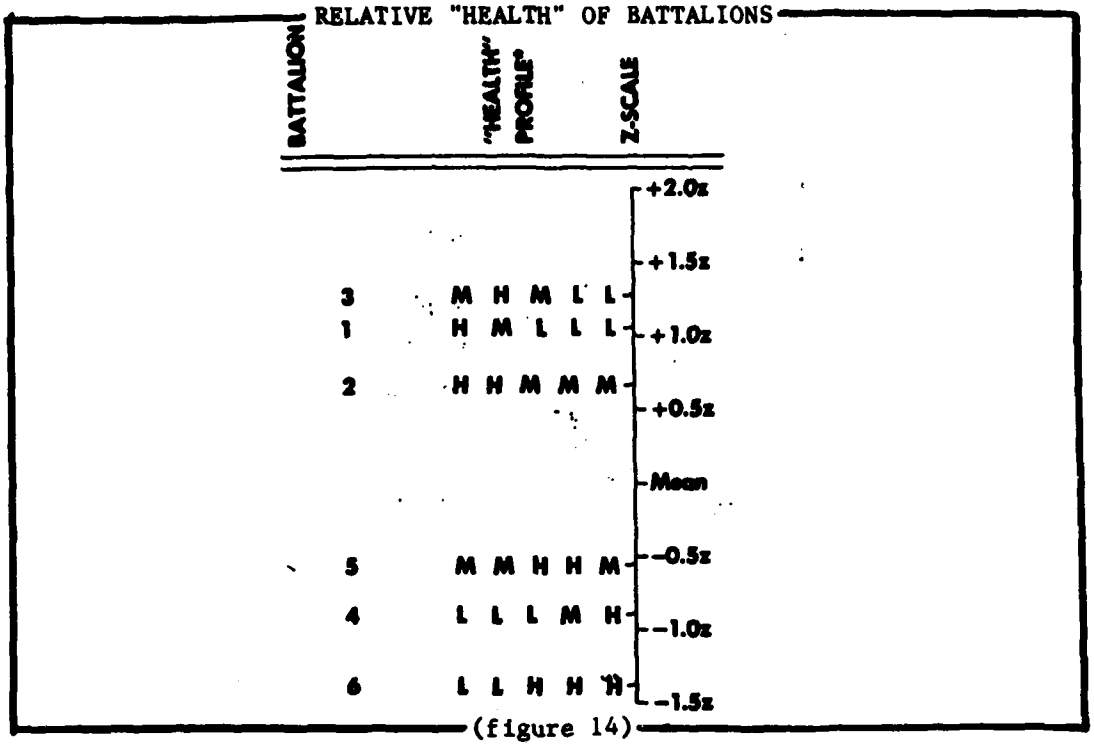
(figure 13)

UNIT "INFORMATION HEALTH"

The information health of a unit is determined by the health of the elements of the IF model. In the Armor Battalion study, five variables were used to measure the state of those elements. These five, for review, were meaning, volume, cost, lag and distortion. It seems, intuitively, that for information flow to be healthy, a unit would have a lot of meaningful information flowing at relatively low cost, lag and distortion. Information health as a standard was derived from research evidence. A fairly detailed technical derivation follows.

The health ratio is represented by the formula: HR=M+V/C+L+D The sum of the values for meaning and volume are divided by the sum of the values for cost, lag and distortion; this gives a measure of the health of the battalion, and a standard against which to guage performance. As an example, take the most effective battalion and the most efficient of the elements, "Remembering". Putting the values for the five variables that make up the health ratio into the formula gives a value of 1.33. For the least effective of the battalions, and again for "Remembering", the formula gives a ratio of 0.94. Therefor the ratio does distinguish between more and less effective battalions. The higher the ratio, the higher the health of the battalion.

In order to decide if the ratio could define a standard for information flow in units, all the health ratios were computed and plotted on a normal distribution shown in figure 14.



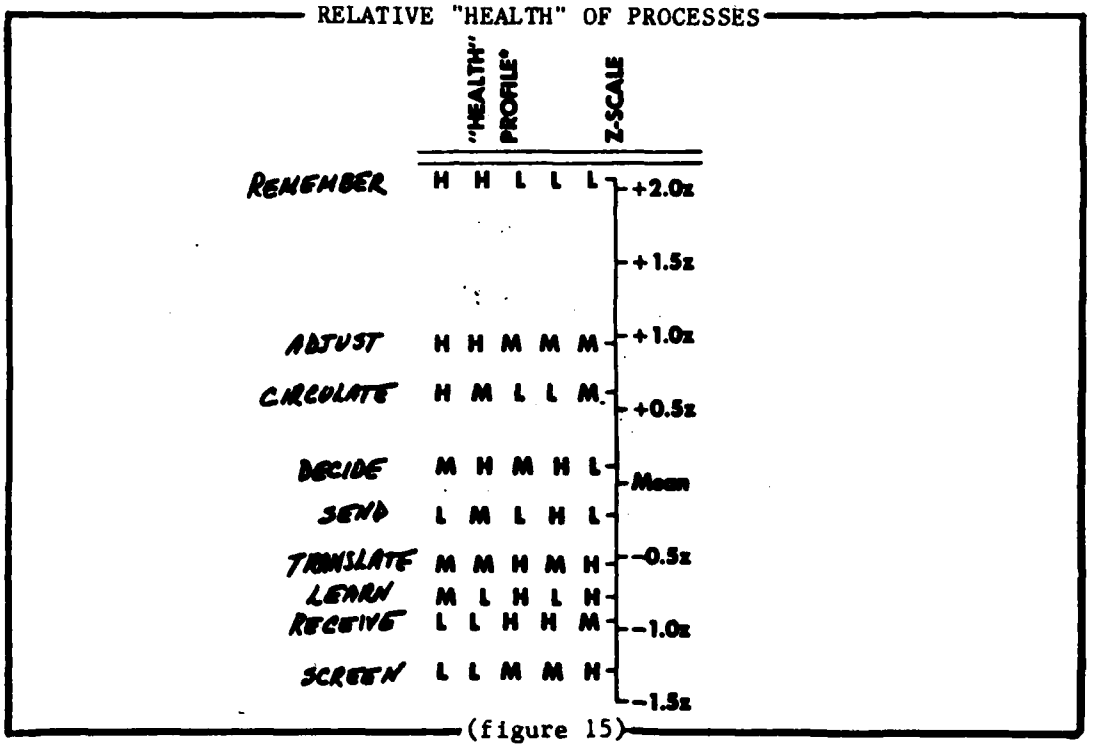
(figure 14)

Notice the relative position of the six battalions. Bns 1-3 (the 3 most effective) all fall above the mean. Notice in particular that Bn 1 and 3 are more than one standard deviation above the mean, with the third battalion apparently the most healthy. In contrast, Bns 4-6 all fall below the mean, with Bn 6, the least effective battalion, more than one standard deviation below the mean. Bn 6 represents the model case of an unhealthy battalion, one that is not performing to standard. That is, it has low volume and low meaning, but high cost, lag and distortion. In other words, Bn 6 is processing relatively little meaningful information but processing it at very high cost, lag, and distortion compared to other battalions.

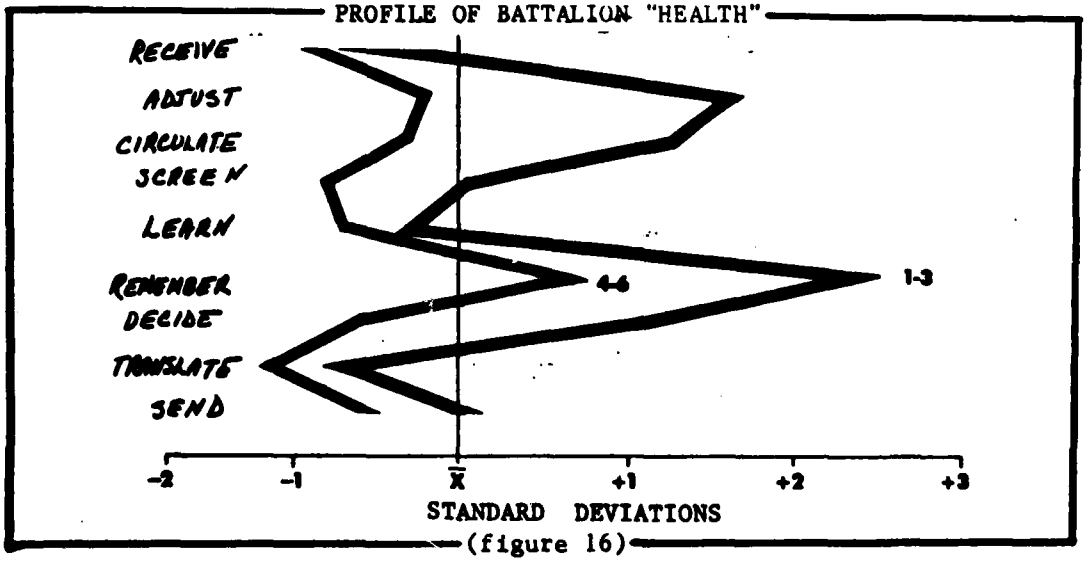
Figure 15 shows all the information elements of the IF model. Notice the relative position of the nine elements, with information storage (Remembering) well above the mean and revising for external reporting (Translating) well below the mean. Second, notice that information storage is the model case of a healthy element. That is, it is high in meaning and volume, but it is low in cost, lag and distortion. The health profile for Remembering suggests that information processing is occurring efficiently in the sense that there is a lot of information being processed, but at relatively low cost, lag and distortion.

Notice also the way in which the elements cluster. The elements above the mean all relate to throughputting, that is, the processing of information within the battalion which is the decision-making process that was shown in figure 5. Also note that the elements that fall below the mean all relate to inputting or outputting information. Here is

evidence that with the exception of Learning, the elements which comprise the decision making process are up to standard. Those dealing with bringing information into and out of the unit (Receive, Screen, Translate and Send) are not.



(figure 15)



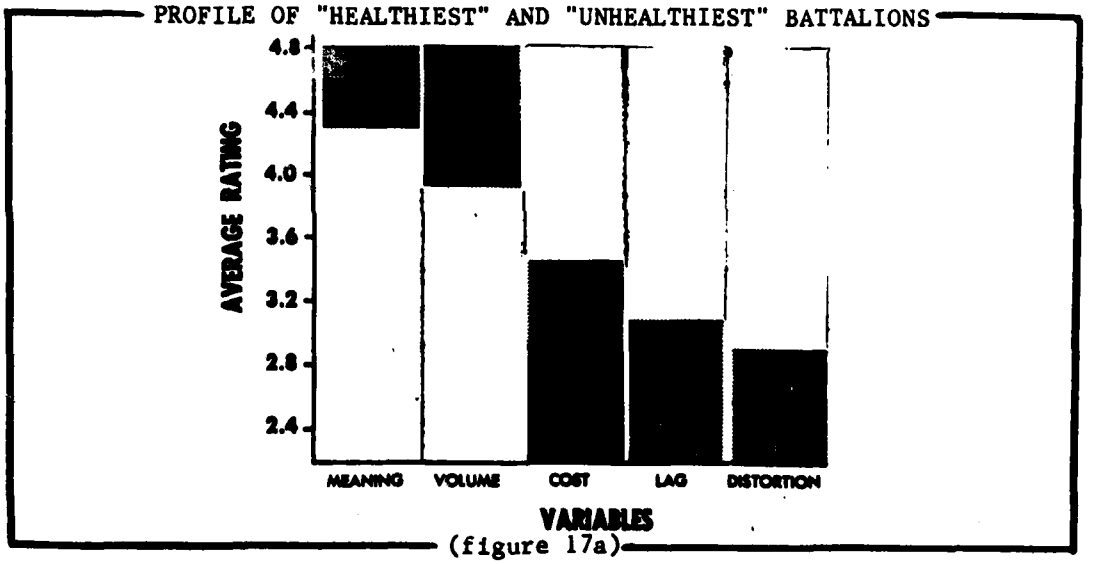
(figure 16)

Because it is possible to distinguish among battalions and among elements of the model in terms of the health ratio, the two sets of data were combined to see if, in effect, profiles of health in the battalions

could be drawn.

For the two profiles in figure 16, the darkest line represents Bn 1-3 (that is, the three most effective battalions), and the light line represents Bn 4-6 (the least effective battalions). For each of the elements, the more effective Battalions are consistently closer to the healthy side--that is, the right side of the graph--than are the less effective battalions. And in all but two cases, the differences between more and less effective battalions are statistically significant. Even in the healthy battalions, Bn 1-3, there are elements that are unhealthy. Three of the elements--Receiving, Learning and Screening--all fall within the unhealthy range, below the standard.

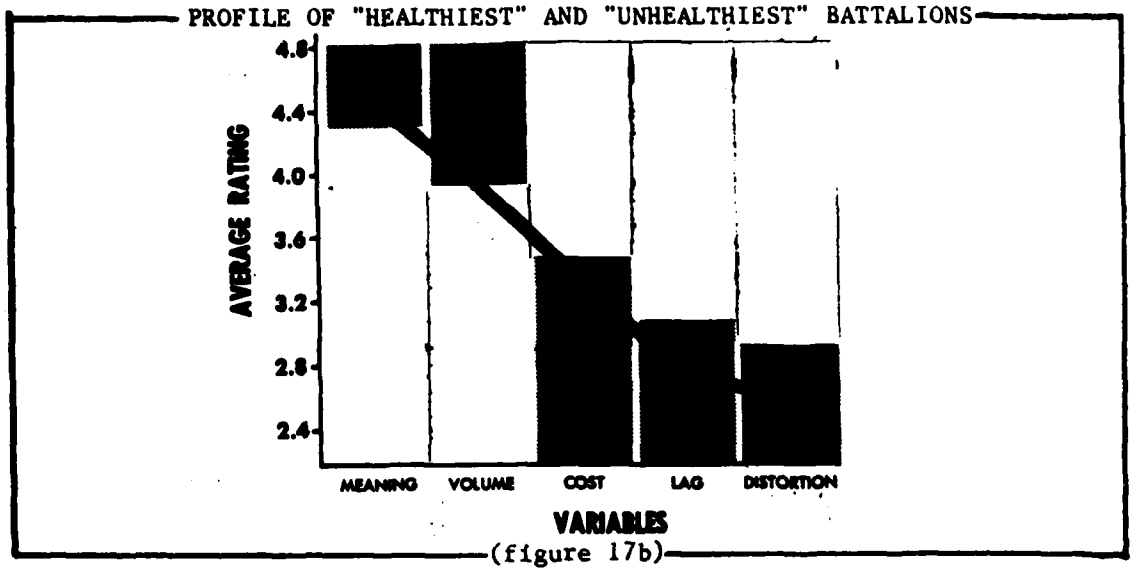
The data from the health ratios can be used to diagnose sources of problems. That is, even in healthy battalions there are unhealthy elements. These might be sources of difficulty that can be analyzed more fully and corrected.



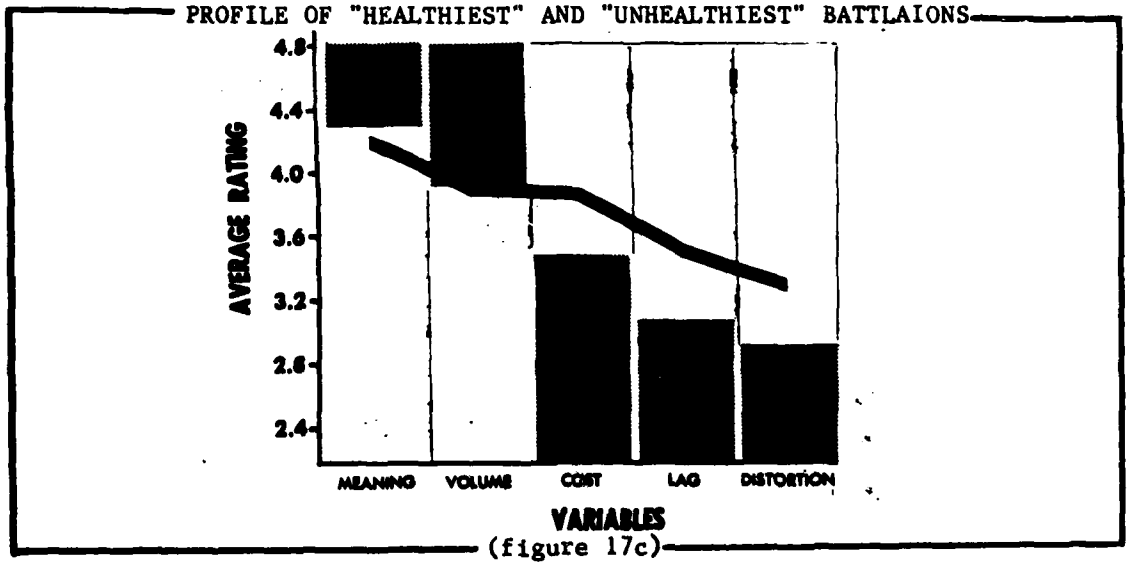
(figure 17a)

A method of plotting the separate values of the five variables relative to the overall range of health for these variables is shown in figure 17a. The dark areas represent the acceptable standard and the light areas represent below standard. For Bn 1, and the five variables under consideration, the values fall within standard. The diagonal line in figure 17b represents the health profile of information flow of that particular battalion.

In four of the five cases, the values for Bn 6 fall below standard as shown in figure 17c. For one case, volume, the value falls more or less on the mean, or the border between acceptable and unacceptable performance.

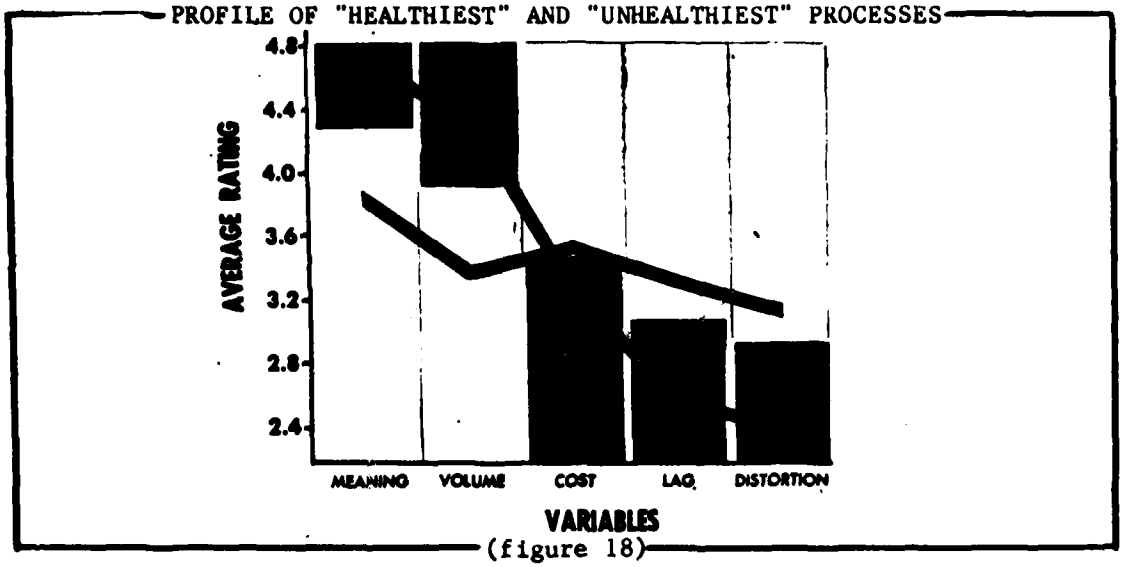


(figure 17b)



(figure 17c)

In the case of Remembering, all of the values fall within standard (see figure 18). Screening gives a picture very much like Bn 6, with the values falling in each case below standard. Profiles of these elements can be developed by plotting the values of these five variables. Acceptable performance is represented by the line passing through the dark areas and below standard represented by the line passing through the light areas.



(figure 18)

These "health ratios" have been developed to measure the health of a battalion's information flow. An examination of the variables making up the health ratio is a means of identifying specific areas of difficulty in information flow. The relationship among the five variables critical to information flow--meaning, volume, cost, lag, and distortion--can be used to monitor malfunctioning within information processing. An increased ability to monitor the effectiveness of an Army unit through its information flow has broad ramifications for the improvement of how the Army runs its organizations.

Any appraisal of information flow effectiveness will have to include an investigation of how information flows in the chain of command. Instructions and commands are communicated down the chain of command, and only from one person to others directly below him in the chain. Reports, inquiries, and requests are nearly always communicated up the chain, and only to the one person directly above the originator. Units do not communicate directly with other units at their level on the organization chart, but instead communicate up the chain until the message arrives at a level where both units share a common commander, then down the chain to the recipient unit. The staff plays the role of communication gadfly--it is given free rein to collect and disseminate nonauthoritative information in its role as an extention of the commander.

Those are the practical facts of information flow in the Army today. For our Army to increase force readiness through impoved information flow, to take advantage of the knowledge that X=H, to reduce the DELTA, there must be a change, a strategy for that change, and a technology--Information Engineering--to accomplish it.

A STRATEGY FOR CHANGE

Information Engineering has been defined in this document as "The process of increasing the efficiency and effectiveness of how we use information to organize matter-energy. Three other terms--information, communication, and meaning--require precise definition for the discussion that follows.

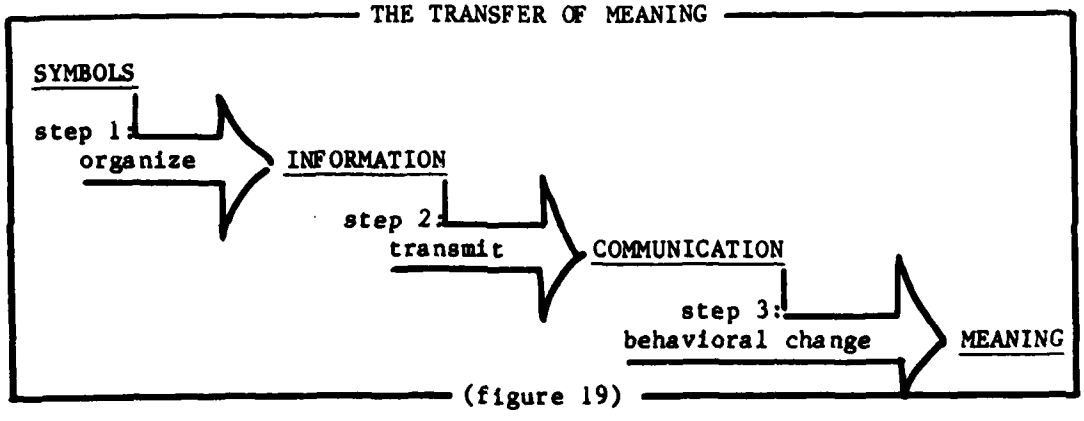
1. Information: The reduction of uncertainty.
2. Communication: The change of information from one state to another or its movement from one point to another, for example, writing (change of state) and sending (movement) a letter asking for a meeting.
3. Meaning: The change in behavior as a result of receiving information, for example, in response to the letter, the receiver sets up the meeting.

Initiating change is the purpose of this document. The change needed can be broadly categorized into two areas: 1) a change in perception, the way we think about information flow and 2) a change in operations, the way we handle information flow.

A CHANGE IN PERCEPTION

A change in perception is critical if we in the Army are going to improve the way we run our organizations. We have to shift our perception of the information flow problem from a hardware technology orientation (exemplified in programs such as C^3I) to one that includes the concept of meaning as defined above. Because of hardware innovations such as television and computers, the amount of information available to Army organizations has increased tenfold, but the ability to digest information, and from that, to make reasoned, timely decisions has not even begun to keep up. The result is that our organizations are being swamped with raw, undigestible information. What we get is information--what we need is meaning.

The steps necessary to transfer meaning are shown in figure 19.



(figure 19)

The logical organization of unstructured symbols (step 1) results in a reduction of uncertainty, producing information. The change of state or place (transmission) of information (step 2) results in communication. If that communication produces a behavioral change in the receiver then there has been a transfer of meaning (step 3). Historically, our treatment of the C3I and other information and communication problems has stopped short of the last step. The focus has been almost exclusively on development of hardware oriented technology encompassing only the first two of the three steps. Automatic Data Processing is an example of the technological development of steps 1 and 2. ADP has concentrated on the development of a technology that can rapidly process electromagnetic impulses. Yet, research has shown that the key to communicating is not technology but people and procedures aided by technology; and that under conditions of stress, sociological, not technological factors are responsible for impaired organizational communication.

The disconnect between steps 2 and 3 is apparently the result of assuming that step 3 happens automatically. That's why we don't usually see terms such as "lag" and "distortion" associated with the study of information flow and communication. That's why "Under no conditions burn down hamlets" becomes "Burn down the hamlet".

The perceptual change needed, then, is to include step 3, the transfer of meaning, in all mental models of information flow. The generation, transmission, amplification, and modulation of electromagnetic impulses associated with C3I and other information flow efforts is a necessary but insufficient condition for information engineering. Only when information flow models are expanded to include the concept of a transfer of meaning, can we make true progress toward increasing force readiness through Information Engineering.

CHANGE IN OPERATIONS

The perceptual change just mentioned can set the stage for capitalizing on an opportunity to improve force readiness through improved information flow. To do that, we must follow up the perceptual change with a change in the way we do business.

The chain of command, and the principles of delegation and mission orders, are critical factors in determining the command climate and therewith, the quality of feedback. Each of these factor's relationship to effective information flow are worth close examination.

CHAIN OF COMMAND

The chain of command is what links an Army unit together. Extend that chain upwards, and the chain of command is what links our whole Army together. The chain of command thus becomes the instrumentality that translates Army goals up at the strategic level into Army war

fighting capacity down at the operational level. It is the instrumentality that makes things happen; that turns information into action. It carries the tasks, the conditions, and the standards.

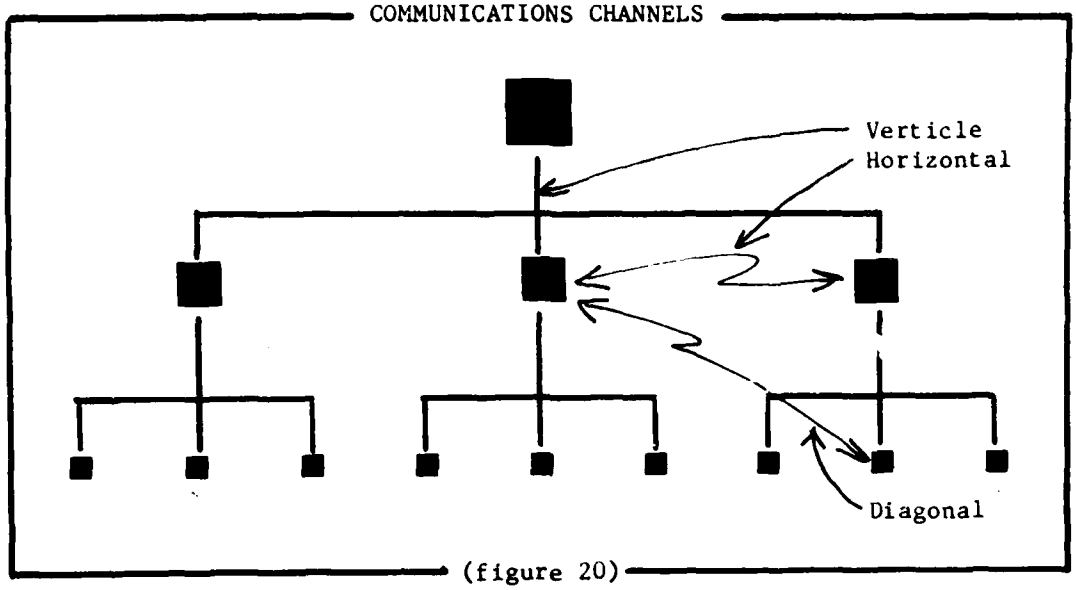
Out of WW II came the "information explosion," with its subsequent social and technological fallout--new information, new problems, new ways to solve them. Complexity began to challenge the capacity of the chain of command, and then, beginning about the time of the McNamara reforms, we began to build, parallel to the chain of command, numerous "stovepipe" arrangements to "help" the chain of command handle complexity.

These stovepipes normally carry a specific and usually "new" kind of information in both directions. The newness of this information, and the strategic level urgency to "get it into the system," drove an evolutionary change in what had heretofore been a normal and routine organizational mechanism. "Staff parallelism" among organizational levels often evolved into mechanisms of pseudo or quasi command--"stovepipes". They handled information and knowledge which the chain of command could only imperfectly understand, and, as this occurred, the principle of "Knowledge is Power" began to operate. With this, the stovepipes began to sap the power of the chain of command, decreasing its ability to turn strategic level goals into operational level action, as well as its ability to discipline those actions. Power began to shift from the chain to the stovepipes. Today, we can see that it has happened most obviously with "people programs." But it has happened also in other areas as well--in military law and resource management, for example.

Stovepipes, whether full-blown or only partially established, are open at the top, open at the bottom, and relatively impermeable and closed in between. The chain of command, with functional staffs, spreading out horizontally at each link, is open at each level. Orders coming down and reports going up can thus spread out through the Army and its functional areas. It is because of this characteristic that the chain of command has the capability not only to command but also to resource, coordinate, integrate and support. Not so with the closed "stovepipes." The stovepipes, by their nature, do not and can not integrate and coordinate their particular activity and knowledge with that of the whole organization. Stovepipe-driven "actions" occurring down at the operational level are thus often a source of discord, and confusion, and distorted, aborted, or undisciplined action.

If the above is a fairly accurate portrayal of a major problem which prevents our Army from moving closer to its total potential, then the solution strategy is obvious: eliminate organizational mechanisms which are or which represent "stovepiping" and quasi-command, and, increase the capacity of the chain of command to manage the complexity which derives from rapid change coupled with an overload of the only resource which we now have in overabundance--information. How do we

give the chain of command this increased capacity? By understanding that the chain of command is structured for vertical communication and that it must be supplemented with both horizontal and diagonal communications channels. (See figure 20)



(figure 20)

In Army organizations with a changing battlefield environment it is unlikely that any commander can depend solely upon vertical information provided by his subordinates and/or superiors to make critical decisions. Much of the information required for effective command of an organization is held by peers and/or by people in diagonal positions within the organization. Success is dependent upon effective horizontal and diagonal communications channels, as well as traditional vertical chain of command or "wiring diagram" communications. The effective use of lateral communication would have circumvented the que that led to the Pearl Harbor disaster mentioned earlier. The information on the Japanese attack was mishandled due primarily to a total reliance on vertical communication at the highest levels.

* * *

On 27 November 1941 a breakdown in a Japanese diplomatic code led to strategic warning that war with Japan was imminent. All overseas posts were notified, and all went on full alert status with the exception of the Hawaiian Islands. There, Admiral Kimmel, the senior Navy Commander, ordered units to attack unidentified submarines but did little more to change the predominantly training atmosphere. General Short, the senior Army commander, did not consider the message a warning of attack since he believed that sabotage was the major threat. The Army and the Navy operated in friendly isolation, each largely ignoring

the other. There was no single commander.

On 3 December, intelligence warnings of imminent attack were reinforced when Japanese diplomats destroyed codes and cryptographic mechanisms. Admiral Kimmel was notified of these actions but made no change in alert status. He did not notify the Army, and the Army did not receive the information through its channels.

On 6 December, intelligence reported that war was certain and that attack was imminent, probably against Pearl Harbor. This fact was reported to the President, but through an oversight it did not reach Army Chief of Staff Marshall or Chief of Naval Operations Stark until the next morning. Admiral Stark was urged to warn Pearl Harbor, but declined, saying that notification was the Army's responsibility. It was then necessary to wait for General Marshall to return from his Sunday morning horse ride. When he returned, he declined a Navy offer to transmit the message, being assured that Army channels could do the job in 20 minutes. In fact, the message left at 0648 Hawaiian time and was sent on commercial cable. It arrived at the cable office at 0733, well after tactical warnings had been received. The message was then sent by motorcycle to Army headquarters. It arrived at 1145, two hours after the attack was over.

* * *

The IF model of figure 4 showed that information in units flows continuously across, among and between all levels, sub-organizations and people in that unit. The consequence of lateral and diagonal communication not being depicted on the wiring diagram is that these two channels are seldom used effectively. This barrier to horizontal and diagonal communication must be overcome if information exchange is to be improved.

In addition to the wiring diagram which formalizes vertical communications, we need the IF model which views Army organizations as information exchange systems. In over 50 iterations of an organizational information flow simulation conducted by information scientists at the Center for Creative Leadership in Greensboro, North Carolina, an important relationship between wiring diagram structure and information flow effectiveness was discovered. Structure, unless forced into consciousness by the decision-maker was ignored in favor of problem solving by individuals or groups. When the chain of command was visibly enforced the resultant preoccupation with vertical communication caused effectiveness in an uncertain environment to crumble under a hierachial arrangement that made little sense for the problems encountered. This suggests that the battlefield environment, though it affects organizational behavior, dictates formal, vertical information wiring diagram structure only when someone decides it does.

RULE OF THUMB:

One good Division Commander used to say, "Don't complain about me 'violating the chain of command' when I talk with subordinates five or six levels down. I command with my chain of command. I'll communicate anyway I can -- up, down, sideways -- with anything I can get my hands on."

DELEGATING

A unit consists of a set of subordinate units; a division of brigades, a brigade of battalions, a battalion of companies and so on. Organizational theory tell us that subordinate units satisfy three conditions. First, the performance, as a whole, of any unit is affected by every one of its subordinate units. This means that every company of a battalion, every platoon of a company, affects the performance of the parent unit. If there is a company which has no effect on battalion performance then the one thing certain is that that company is not a part of the battalion.

Second, the way that any subordinate unit affects the parent unit depends on what at least one other subordinate unit is doing. Or, put another way, no subordinate unit has an independent effect on the parent unit. The manner in which the first squad of the 2nd platoon affects the platoon as a whole depends on what the 2nd and 3rd squads are doing. To take an obvious example, say the 1st squad is part of a platoon defense. If the 2nd and 3rd squad cannot hold their sectors, then regardless of how strongly and skillfully the 1st squad defends, the platoon cannot successfully accomplish its mission. And that's all the second condition says, that the way any subordinate unit affects the parent unit will depend on what at least one other subordinate unit is doing.

The third condition is the most complex and important. It says that if a set of subordinate units is grouped, it forms a new unit which is also a subordinate unit. The new subordinate unit will be subject to the same first and second conditions as the original subordinate units were. That is, each subordinate unit will affect the performance as a whole and no subordinate units will have an independent effect on the performance of the parent unit.

When those three conditions are put together, it turns out that an organization is an indivisible whole--not just a colletion of parts to be analyzed and optimized independently. Independent optimization is in fact, sub-optimization, and when a commander does not delegate, he prevents his subordinate commanders from operating their units as a whole.

This "philosophy of the whole" will lead to a conversion of our preoccupation with the parts of which units are composed, to a preoccupation with the whole unit and with the larger units of which it

is a part. Without a philosophy of the whole, when explaining some thing, the thing would be taken apart, each part explained, and the explanation of parts put back together again. With a philosophy of the whole, exactly the opposite is done. The thing to be explained is not viewed as a whole to be taken apart, but rather as part of a larger whole. Then an explanation of the larger whole is made followed by an explanation of the original thing based on the explanation of the larger whole, not of its component parts.

Commanders decline to delegate authority and responsibility to their subordinate commanders because they want to personally optimize (from their point of view) the performance of the subordinate commanders' units. But if the subordinate commanders' units are operated in such a way that each independently performs as well as it possibly can, then the subordinate commanders' unit as a whole will not perform as well as it can. And conversely, If a unit is performing as well as it can, none of its subordinate units will be. A continuation of the platoon in the defense example will serve to clarify and underscore this critical fact.

In this example, the subordinate commander is the platoon leader and the subordinate units are the three squads organic to the platoon. If each of those three squads independently set up the best possible defense, then each will be located on high ground in a circular configuration! That means, of course, that the platoon will not have an optimal defense. Conversely, if the platoon operates optimally, then the squads will be arrayed more or les linearly, tied in, and coordinated. But the squads will not be optimally operating from the independent squad point of view. What the philosophy of the whole says is that the performance of a unit or agency is not the sum of the performances of the subordinate units, but is a consequence of the relationships between the performance of the subordinate units. It is how performance of subordinate units relate, not how it occurs independently of other subordinate units that makes the principles of decentralization and delegation so important.

In addition to the philosophical argument for delegation just explained, there is another more mundane argument and that is, to motivate through involvement. The perceived quality of a decision is a function of who is involved in that decision. Delegation means involvement--the more that is delegated, the more people are involved--those involved "buy into", then "own", then feel responsible for, the decision. If a given subordinate commander is involved in a decision, the decision is usually seen as effective by that subordinate commander. If not, it is not. Where many subordinates are involved in decision-making, superiors seem to think decision quality suffers, while those subordinates involved think it is enhanced. This is the "dilemna of delegation". Because lower level commanders believe their involvement improved the quality of the decision, they tend to be committed to it. That payoff must be weighed against the higher level

commanders' belief that the involvement of subordinates reduced decision quality. Thus, to many commanders, delegation is seen as a threat to personal success.

RULE OF THUMB:
Delegate everything.

MISSION TYPE ORDERS

Delegation of authority carries with it a responsibility to issue orders and take other necessary actions to ensure mission accomplishment. How much detail should orders contain? Should the order specify how to accomplish a mission? Should procedures be specified? What does all this have to do with the flow of information?

It is a fact of human behavior that the more detail a commander gives when issuing an order, the more secure and confident he will be with the probability of successful outcome. Commanders are prone to assume that the most efficient way to ensure mission accomplishment is to include in their orders, a set of specific procedures which explain in detail, how the mission is to be accomplished. Modern communication technology has made this more and more commonplace. Division Commanders run company contacts, the National Security Advisor runs the "Mayaguez" incident, the President runs the Iran hostage rescue attempt--with the nation looking on as TV spectators. This "stovepiping" is a long way from "One if by land, two if by sea".

This approach to communicating orders has as its key element, a set of procedures, a "receipe" for task accomplishment. The receipe is also called an "algorithm", which in a mathematical sense, is a formula which specifies a mechanical or recursive receipe for computational procedure. Algorithms are appropriate in those cases in which procedures are in themselves, important, or when safety is an overriding factor. Crew drill is an example of procedural importance and the fuzing of a nuclear artillery round is an example of a case in which safety considerations make the algorithmic method appropriate.

The use of algorithms in giving orders has always led to preoccupation with procedures to the point that rigid compliance with the procedures (the algorithm) tends to dominate and the specified mission becomes secondary or is disregarded. Preoccupation with procedures rather than clearly stated "end state" is where "regulations" (military and governmental) are born. Much information overload results. (It is precisely the recognition of this phenomenon that is pointing the IG away from compliance and towards systemic inspections.) Thus we see rigid, inflexible orders that preclude innovation and experimentation and don't ever get better because they can't change. Since the number of algorithms available for the accomplishment of any

given mission is infinite, the argument that mission accomplishment has been "optimized" is invalid. True optimization in this regard is a mathematical as well as practical impossibility. What is meant is "sub optimization" (optimization within the confines of a given set of circumstances and assumptions) and, which violates the rule that if the subordinate commanders' units are operated in such a way that each independently performs as well as it possibly can, then the subordinate commanders' unit as a whole will not perform as well as it can.

This algorithmic approach can be contrasted with a "mission-type" order approach. A mission order specifies a method of behavior which will tend toward mission accomplishment. The difference between the two can best be described by example.

* * *

1944 - Order from Marshall to Eisenhower:

"Cross the Channel, enter the heartland of Germany, and free the continent of Europe."

1965 - Order from Wheeler to Westmoreland:

"Achieve the following results in 1966.

1. Increase the population in secure areas to 60%.
2. Increase the critical roads and railroads open for use to 50%.
3. Increase the destruction of VC/PAVN base areas to 40-50%.
4. Ensure the defense of all military bases, political and population centers and food-producing areas now wnder government control.
5. Pacify the four selected high-priority areas -- increasing the pacified population in those areas by 235,000.
6. Attrite, by year's end, VC/PAVN forces at a rate as high as their capability to put men into the field."

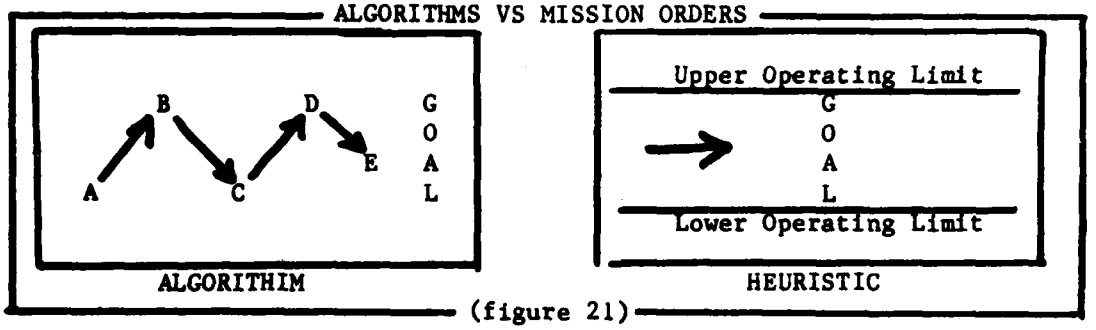
* * *

As a peacetime example, consider the training that gets us all physically fit for combat. The Soldier's Manual for MOS 11B (all skill levels) requires that infantry soldiers be able to acheive a minimum passing score (60 each event, 300 total) on the APFT twice each year. Most Division Commanders specify an algorithm to acheive that goal. Typically, it might be "run 15 miles per week in combat boots and

preceed each daily 3 mile run with 10 minutes of warm up exercises from the Army 'daily dozen'". The corresponding mission order might be "keep physically fit for combat".

In the first case there will be a high degree of superior commander security, frequent compliance inspections, subordinate commander frustration, and average PT programs which may or may not achieve the goal. In the second case there will be flexibility, experimentation, innovation, many remarkably effective PT programs and some failures. In this case, the onus is on the selection system to produce innovative commanders. The difficulty in doing that is a very important part of the reason why there has been a general trend away from commanding through mission orders. And there is a perceived payoff for commanders who follow the algorithmic method. It is that algorithms can be easily checked. Algorithms are very easy to check for compliance because what is being checked is the algorithim itself, not the accomplishment of the goal (in this example, "physically ready for combat"). The commander who uses the easier algorithm method checks neither what he thinks he's checking, nor what he should be checking.

Figure 21 shows graphically what the commander must accomplish.



(figure 21)

Using an algorithm, he need only check progress from state A to B, state B to C, etc, until arrival at state E, which may or may not correspond to goal accomplishment (And, incidentally, this method is commonly used to generate reams of statistical progress data which further compounds the problem of information overload). Using a mission order, the commander must continuosly compare actual state with goal state while simultaneously "managing" the upper and lower bounds to prevent failure. The subordinate commander has the flexibility to operate anywhere within the upper and lower limits imposed by his commander. This permits subordinate commanders to "relationship" with one another.

An atmoshpere of algorithms constrains towards commanders themselves becoming more concerned about prescribing algorithmically. Adding to the problem is the fact that as stress increases (battlefield situation), commanders tend to revert to the algorithmic approach, and set procedures are invoked (see incl. 2), thus compounding the

information overload problem. Step by step instructions take time...conversely, little time is spent on spelling out task, conditions and standards--criteria. Time spent spelling out criteria and implications of desired end state is ten times more valuable than time spent spelling out how to get there. End state, mission order commanders are "visionary". Algorithms relate to the "letter of the law" whereas mission-type orders correspond to the "spirit of the law"--to meaning. Those who command by algorithm are focused on step 2 of figure 19. They are concerned primarily with the transmission of information--downward. They command by laying down the "letter of the law" in great detail. Those who use mission-type orders as a method of command, attempt to convey the "spirit of the law" and are focused on step 3, meaning. They look for the desired behavioral change rather than compliance with a set of procedures.

Overuse of algorithms has serious impacts on our leaders' ability to innovate and experiment. There results a corresponding stifling of initiative at all levels. Intuitively, most of us feel that initiative, flexibility and experimentation can lead to better solutions and higher performing Army units. In wars past, we have always taken pride in "GI ingenuity". We may be losing this capability. In studying the nature and characteristics of high performing units described in inclosure 3, the following hypotheses are directly applicable:

- THERE WILL BE A GREAT DEAL OF EXPERIMENTATION AND REHEARSAL IN A HIGH PERFORMING UNIT. VARIOUS WAYS OF OPERATING WILL BE TRIED WITH ONLY TEMPORARY FIXATION ON "THE ONE BEST WAY".

- PERFORMANCE BREAKTHROUGHS WILL OCCUR IN UNPLANNED WAYS.

- SOLDIERS OF A HIGH PERFORMING UNIT WILL TALK ABOUT AND DEVELOP SCENARIOS OF DESIREABLE END STATES FOR THEIR UNIT.

- THERE WILL ALWAYS BE DISCREPANCIES BETWEEN "WHAT THE BOOK SAYS" AND WHAT THE UNIT ACTUALLY DOES. CIRCUMVENTION OF THE RULES TENDS TO BE OVERT AND NON APOLOGETIC.

- EXTERNAL CONTROL OF A HIGH PERFORMING UNIT'S OPERATIONS ARE VIEWED BY ITS SOLDIERS AS AT BEST IRRELEVANT AND AT WORST, AS POSITIVE IMPEDIMENTS TO PERFORMANCE.

- EFFORTS TO DICTATE PARTICULAR KINDS AND QUALITY OF OUTPUT OF A HIGH PERFORMING UNIT WILL TEND TO DEPRESS MOTIVATION.

If these hypotheses are valid, then there is an inverse relationship between algorithims and performance. The best way to "grow" a high performing unit may be to produce the command environment which will allow these hypotheses to be fulfilled. Mission-type orders are a critical ingredient of the desired environment.

Attempts to use algorithims prevent consideration of such variables as mission, geographical location (weather, terrain, etc), TOE modifications, DAMPL, or other resource constraints, and will seriously curtail initiative, innovation and commander prerogatives. Concommitant chain of command compliance inspection will cause further alienation and frustration on the part of commanders who have the desire and ability to operate from mission orders. As a result, information flow is inefficient and ineffective.

RULE OF THUMB:

Specify task, conditions, and standards--not step by step procedures.

COMMAND CLIMATE, FEEDBACK AND DISTORTION

We have heard much, lately, about "command climate"--the atmosphere that prevails in any given unit. The climate is important not only because it determines, in a general sense, the quality of life in the unit, but also because it is the atmoshpere in which information flows. The command climate can be either a deterrent to, or catalyst for, effective information flow.

The commander does not "handle" people, he motivates, guides and organizes his subordinates to do their own work. His tool--his only tool--to do all this is information flow. Following is a list of one current Division Commander's "Oughts" and "Ought Nots". Getting "oughts" to happen and preventing "ought nots" from occuring is an information flow problem and demonstrates the linkage between command climate and information flow effectiveness.

* * *

THINGS COMMANDERS OUGHT TO ALWAYS DO

1. Don't wait to be asked--sound off with your personal opinion to let the boss know he is doing a "Dumb Thing". Those who don't or won't, worry the boss; those who do and will, earn the respect of the boss.

2. Constantly teach, insist, promote, and encourage your NCOs and officers to talk to their troops, listen to their troops, take care of their troops by planning and organizing a hard but productive duty day characterized by intelligent on-the-spot corrections.

3. Live, breathe, eat, sleep, educate, and understand that there are no fairy godmothers listed in the RSOP--deadlined equipment stays deadlined, missing repair parts and equipment remain missing, individual and unit training deficiencies go uncorrected, unzeroed weapons don't get zeroed, scheduled POM checks are cancelled, and family problems grow

bigger. No-notice deployment means as-is deployment, and it ain't done by magic.

4. Train your subordinates, and insist they train their subordinates, to be able to do an even better job than you or they can do in your job and theirs. Be careful. This one gets mostly lip service.

5. Know what's really going on below decks. Find out for yourself.

6. Enthusiastically support your fellow commanders by bragging about their achievements to your boss, and by passing on to them both good ideas and bad news so they can profit by wha. you've learned the easy and/or hard way.

7. Cut your NCOs and junior officers into the decision-making process whenever you can. Give them a fair vote in unit activities because involvement means commitment--and its' their outfit too.

8. Don't assume nothing. Murphy is a heck of a lot smarter than you are. He can also be in ten places at once. You can't.

9. Recognize officially, formally and/or informally the day-to-day contributions of your officers and NCOs, and particularly your troops.

10. Make sure your people know what's right, why it's right, how to do it right--then do it right the first time every time.

THINGS COMMANDERS OUGHT NOT NEVER DO

1. Rigidly adhere to an Army, FORSCOM, Corps, or Division Regulation, Directive or Policy--or something you think you heard the CG say--and by doing so forfeit an opportunity to improve training or morale, develop junior leaders, manage resources more efficiently, and/or increase individual or unit combat readiness.

2. Violate the "Don't Do Nothing Dumb" rule, or fail to bring a "Dumb Thing" problem to the attention of your immediate boss--immediately.

3. Do such a sloppy job of before-the-fact training management--or allow your subordinates to do such a feeble job of training execution--that your soldiers, crews, teams, squads, sections, platoons, and/or companies waste time, practice sit-around-and-wait, and/or fail to receive a full, productive, challenging, satisfying, hot-diggity training day.

4. Fail to take positive, appropriate, long term corrective action to identify and correct individual and unit deficiencies in training, administration, logistics, supply, property accountability, discipline, maintenance, leader development, and soldier and family welfare.

5. Conduct an errorless training exercise, because that demonstrates you failed to correctly identify the individual and/or unit skills your folks cannot do very well, wasted valuable individual and/or unit time reinforcing skills already attained, or didn't fully recognize what battlefield deficiencies needed correcting to begin with.

6. Allow leaders at any level to permit any garrison or field mistake to continue without an on-the-spot, civilized correction.

7. Eyewash anything, at any time, at any place, for any reason.

8. Create an actual or perceived climate that discourages tell-it-like-it-is leaders.

9. Fail to underwrite the honest mistakes of subordinate human beings.

* * *

Of course, fine sounding phrases, though well intentioned, don't of themselves create the ideal command climate. Those policies must be acted out all the way down the chain of command. Oughts and ought nots such as these must result in behavioral changes in order to create an atmosphere in which information flows efficiently and effectively. The resultant command climate will foster mutual trust and respect. Research has shown that there are at least five principal dimensions of an "Ideal Command Climate".

- Confidence, Trust, and Credibility: The essence of "believability" of the organization as a whole and the individuals who comprise it in terms of expertise, reliability, and intentions.

- Supportiveness: This relates to command style and the level of human relations competencies.

- Participative Decision-Making: The extent of give and take of influence within an organization.

- Candor: Openness in sending as well as receiving.

- Informing: How much subordinates feel "in the know".

Go back again to that highest performing unit with which you have been associated. The supposition earlier was that the reason it was high performing, was because of the way information flowed in that unit. Information can flow efficiently and effectively only if the command climate is "right". Again, put in mind that high performing unit and the command climate that prevailed. Ask yourself the question, "was there confidence, trust, credibility, supportiveness, participative decision-making, and candor; and was everyone kept well informed? Then

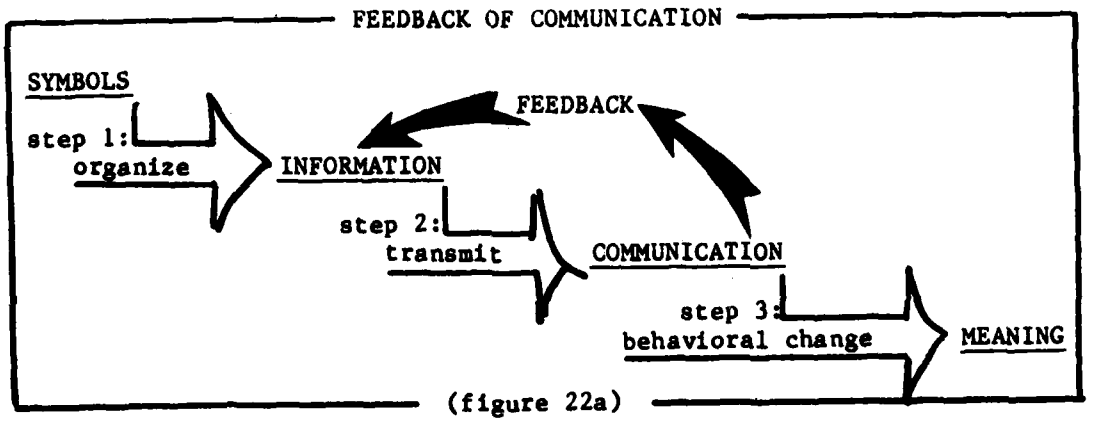
contrast that unit with the worst unit with which you have been associated. In that worst unit you most likely found a command climate with:

- Multiple layering
- Sub optimization
- Policy of no surprises
- Lip service to feedback
- Over centralization and non delegation of authority

The extent to which the command climate is supportive, trusting, participative, candid and open is the extent to which information flow within that unit will be efficient and effective. Since about one half of the information flow in a high performing unit is feedback information, a unit without effective feedback has disadvantaged itself from the outset by almost 50%.

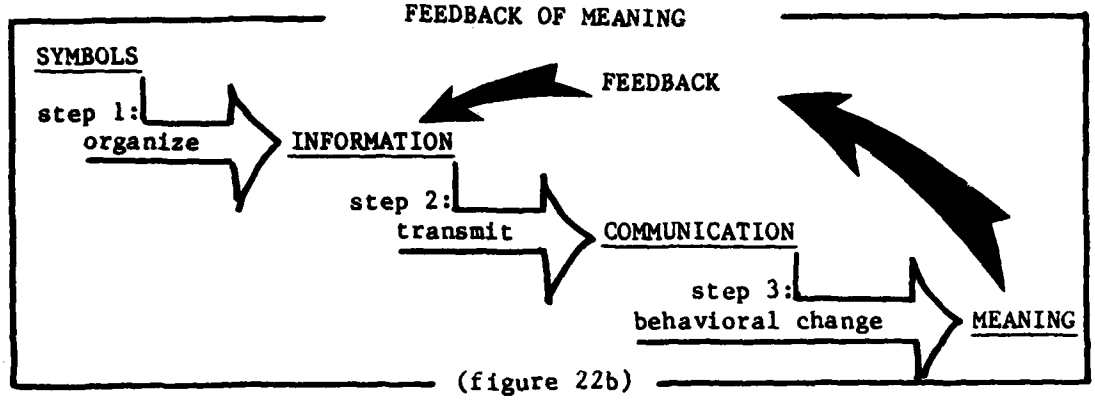
Feedback is critical to healthy information flow. In order for a unit to do anything successfully, it has to have reliable, undistorted feedback. Research shows that in high performing units there is a freer flow of unguarded feedback than there is in less effective units and subordinates are more satisfied with their jobs.

Refer back to figure 19, The Transfer of Meaning. It was explained that most information flow stopped short of step 3. That is, meaning was taken for granted. That diagram with a feedback loop added is shown in figure 22a.



(figure 22a)

The point is that what is being fed back is likely to concern only communication, not meaning. The system needed is one that feeds back meaning and is shown schematically in figure 22b.



(figure 22b)

Most feedback is vertical upward, which means it must go against the general flow of information. The commander states his expectations through the mechanism of regulations, policy directives and orders. Subordinates have no such formal means for stating their expectations. Their informal means may from time to time include attitude surveys, and various councils. But their primary mechanisms for stating expectations are upward feedback through the chain of command.

The Army, communicating its expectations downward, and the soldier, communicating his expectations upward, are both inadequate--inadequate to the task of transferring meaning. The volume of regulations and the reliance on the written word make it difficult for the commander to make his expectations clear, down at the lowest level. And for subordinates, communications upward through the chain means that they must act directly against the flow of power and authority coming down the chain.

The chain must be open--open to upward vertical communication and open to horizontal and diagonal communication. How often have you sat in a meeting in which the senior person present has said, "Now, I want feedback" and then proceeded to totally disregard any and all input from others present? Or, after giving a speech in which he extolls the virtues of feedback and participation, his body language and facial expression make it crystal clear that once he has spoken, further discussion in unnecessary and unwanted. He may not even be consciously aware that his actions and demeanor have stifled feedback. And that, more often than not, will lead him to misinterpret the lack of participation as unqualified support.

Openness means more than a sincere willingness to listen. There are two significant aspects of openness: Openness in sending and openness in receiving. This distinction is important to keep in mind since the consequences of lack of openness take on two potentially different dimensions. A lack of openness in sending leads to distrust and loss of credibility, whereas a lack of openness in receiving leads to filtering and distortion. Distortion includes the blockage or

omission of information, summarization or condensation, changing the form, and expanding or emphasizing certain details. Research on distortion has produced three major findings:

- A bias exists towards screening certain types of information from upward transmission.
- Low trust in the receiver results in significantly more suppression by senders, especially if the information sent reflects unfavorably on the sender.
- Distortion is inversely associated with job satisfaction and, therefore, individual and group performance.

Those findings have important implications for information flow in general, and feedback in particular. Table 4 is a list of facts that drive the dynamics of feedback and determine the efficiency and effectiveness of information flow.

FEEDBACK FACTS

1. Commanders misperceive subordinate's freedom to communicate upward.
2. Commanders attach less significance to commander-subordinate interactions than do their subordinates.
3. Commanders perceive messages favorable to subordinates as less accurate than messages which are perceived as unfavorable to subordinates.
4. Individuals who disagree with the contents of a message will omit more of that message's content, in retransmitting the information, than they will if they agree with the message.
5. Distortion occurs in the direction of pleasing the recipient, particularly when the recipient has power over (outranks) the sender.
6. The stronger the career mobility aspirations of subordinates the less accurately they communicate problem-related information upward.
7. Army officers at all grade levels consistently perceive themselves to be providing more downward feedback than their subordinates perceive to be the case.
8. The lower the organizational level, the greater the difference between actual feedback rates in a given superior-subordinate pair.
9. A reduction in the judgement of the first line supervisor and the ensuing conflicts that arise between line and staff results in supervisors safeguarding themselves by always communicating in writing--this encourages the reliance on copies of messages etc. to

protect oneself in the event of disputes. Satisfaction and morale are consequently lower.

10. The capacity to exert influence upward through feedback is essential if a leader is to perform his leadership function successfully.

11. The informal channel ("grapevine") is frequently quicker and more efficient than formal communications channels. Many problems get solved in these channels rather than formal ones particularly at higher levels.

(table 4)

It isn't enough just to want feedback. One must understand the natural inborn human biases that change and distort what is usually assumed to be unbiased feedback. Only then can commanders put feedback in context and glean from it, accurate meaning.

RULE OF THUMB:
Release the "push to talk" switch.

APPLICATIONS

The chain of command's communicating competence, delegation skill, ability to motivate through mission-type orders, and ability to establish an efficient and effective communication climate are all critical components of "X"--those measures that will enable our Army to increase its force readiness. Information, "H", is the tool by which we can realize those potential gains.

The task of increasing the efficiency and effectiveness of information flow, under conditions of battlefield stress and/or information overload, is receiving top priority by commanders at all levels in the chain of command throughout our entire Army. There are two main strategies to attacking the information overload problem. The first is to apply measures designed to reduce the demand for information and the second is to apply those measures which will increase our ability to process information.

REDUCING THE DEMAND

In every headquarters in every Army unit in every theater of operations, there is an astounding volume of information handled each day. Since we as individuals seldom see more than our own little slice, we don't have a true appreciation for the total volume of information flow. And paperwork represents only a fraction of information input--telephone calls, meetings, briefings, personal observations, and

conferences all contribute to the glut of information.

It takes dedicated, usually painful effort just to identify the utility of routine reports. Who studies or assesses the utility of phone calls, meetings and briefings? It is not particularly surprising to find that many, if not most, reports serve no purpose whatsoever except to keep some staffer happy as he fills his filing cabinets with "If the boss ever asks me, I'll have an immediate answer" papers. As each commander comes and goes, his interests are different than his predecessor's--so each asks for additional/different information, reflecting his particular interests and problems. But how often is that information collection effort purged? Year after year, commander after commander, reports keep piling in. The best intentioned efforts at reduction are often met with resistance throughout the chain of command--even by those who have to waste their time producing it. There is security (and power) in information.

A recent attack on the paperwork information overload problem in a major unit might serve as a model for other information input overload sources. This recent attack met with the usual response--"We need all this information, we can't do without these reports." It took a random reduction of half of all reports to get the effort moving. Then, using a systematic, zero based approach, each report, each piece of paper was challenged:

- What's the purpose of this report; why is it prepared to begin with?
- Who prepares it; why that person?
- Who has to/can sign it; why that person?
- Who finally gets it; why that person?
- What does he do with it after he gets it; why does he do that?
- Who has to endorse and/or approve it and/or authenticate as it goes up the tape from the originator to the final recipient?
- Why do those who indorse/approve/authenticate it have to do that; what does this accomplish?
- How is it prepared; does it have to be typed; why?
- Could it be handwritten/telephoned instead; if not why not?
- How often is the report required; why that frequently; what happens if it's less frequent?
- Does it duplicate information that is or could be provided by an existing computer program, or one easily designed?
- Is it a practical tool for positive command or staff action to identify problems; help the subordinate unit commander fix a problem? Or:
  - Is it used primarily to compile questionable statistics?

•• Is it primarily CYA to force subordinate unit commanders into reporting compliance because we don't trust them?

...and its an ongoing process--requirements for new or additional information keep popping up. Each new requirement is evaluated according to the following criteria:

- When in doubt, eliminate.
- If it doesn't leave the unit, or doesn't end up in an official file, don't type--write (mandatory).
- Recurring or standard reports or requests for administrative action should be changed to "fill-in-the-blanks-in-pencil format.
- No "I certify" allowed.
- Where possible, change signature requirements from "commander only" to "a responsible individual".
- If it's routine, forget the who-shot-John CYA, use the telephone.
- Automate whenever possible, and use computer print-outs sent down to appropriate unit for pencil edit (rather than report up from unit).
- Any report for which no positive action was taken after 3 submissions, eliminate automatically.
- Cut out intermediate stops unless those headquarters have a legitimate reason to get into the act--no rubber stamping.

...and here are the results:

PAPERWORK REDUCTION

Total number of documents reviewed	540
Total number of documents changed	(58%) 312
Eliminated	(26%) 141
Level of initiation changed	5
Frequency changed	75
Signatory responsibility changed	5
Typed to handwritten	42
Typed to telephonic	11
Format simplified	21
Automated	4
Combined	8

(table 5)

Table 5 shows data only for written reports. What would happen if we could do the same for briefings, phone calls, etc.? How many more hours of troop time, commander time, would be made available? Would information flow be better able to carry the important things?

INCREASING THE CAPACITY

The second strategy of attack on the information overload problem is an effort to increase our units' capacities to process information. This capacity is nowhere more critical than in our Tactical Operations Centers. The availability of "raw data" in TOCs has been a commonly accepted measure of TOC effectiveness. Most of us have seen high ranking officers enter a TOC during a CPX or FTX, and, after a cursory check of various data displayed on maps, of the number of messages being "processed", and a short update briefing by the TOC duty officer, make a pronouncement on the "efficiency" of that TOC. But it is not the amount of data availabe that counts--it is the meaningful arrangement of that data that assists the commander in commanding. There are many new techniques just now evolving for handling the "information explosion". Man is adapting and adjusting through research into areas such as optical fibers and holography. Following are applications of two tactics for producing meaningful arrangement of information and represent "what can be".

1) Symbol Compression - the collection of data in an organized but small place.

2) Intelligence Array - the arrangement of symbols to ensure the communication of correct doctrinal action.

Symbol Compression

Man has chosen certain symbols to represent ideas. The most advanced and most widely recognized symbol system is the printed word. Recently man has employed machines to handle the transmission and storage of words. To be sure, information handling has been accelerated many times over because of the imaginative use of machines. Symbol compression is not a further use of machines, but a further use of the symbols.

Creating new symbols has been one approach. but the problems of converting those symbols to managable machine food has set real limits on how to convert ideas to new symbols. One approach, however, that has been overlooked is a new language system that can aggregate many different symbols in the same space. This advanced language system, SYMCOM, qualifies as a language and not a tool because it introduces a syntax to the collection of visual symbols. The language has a "look" to it. Just as the written word has a linear construction of words into blocks or paragraphs, SYMCOM has its own construction called the mandala.

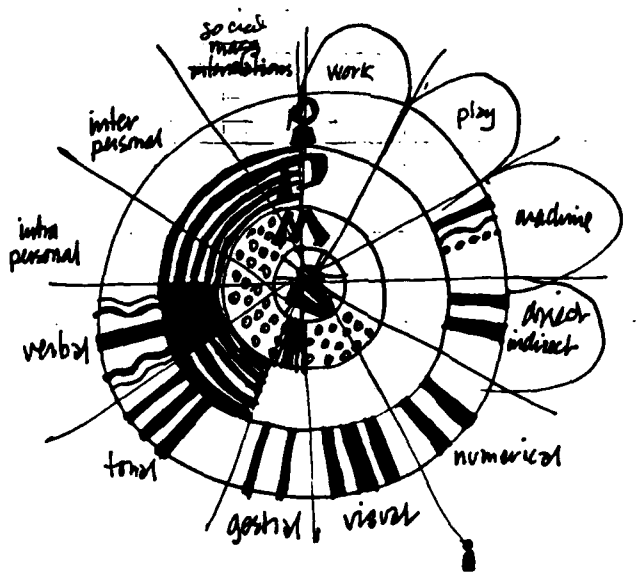
The mandala is an information grid placed within a circle. Meaning is attached to that grid by placing marks or symbols around the center of the grid in radiating bands. Separate domains of subject dimensions are further articulated by using the radii of the clock. Within this structure a number of syntactical combinations are possible. The prime benefit is, of course, that one can collect one hundred symbolized

meanings in the space of a quarter.

The nature of the syntax is suggested but not limited to the following graphic treatment:

SUBJECT: That area of the symbol highlighted (flashing on a CRT).
OBJECT: That symbol centered on the mandala.
EMPHASIS: Those sub areas of the mandala with richer tone (color/intensity).
CAPACITY: The bands of meaning with a percentage of the band filled in.
FUNCTION: In the sense of interface, the outer band would be the most visible articulation of ways to find out more about the subject.
HEALTH: Color treatment of the various symbol and meaning areas would reflect their relative state of readiness or perfection.
SPECIAL RELATIONSHIP: Overprinted or telestrated arrow connectors could sequence the dependencies of various symbols within the mandala.

SYMBOL COMPRESSION



(figure 23)

This kind of compression would not replace language as we know it, but could compress the meanings associated with people, places, things and selected processes. For example, it is conceivable that a unit symbol would include five mandala symbol compressions:

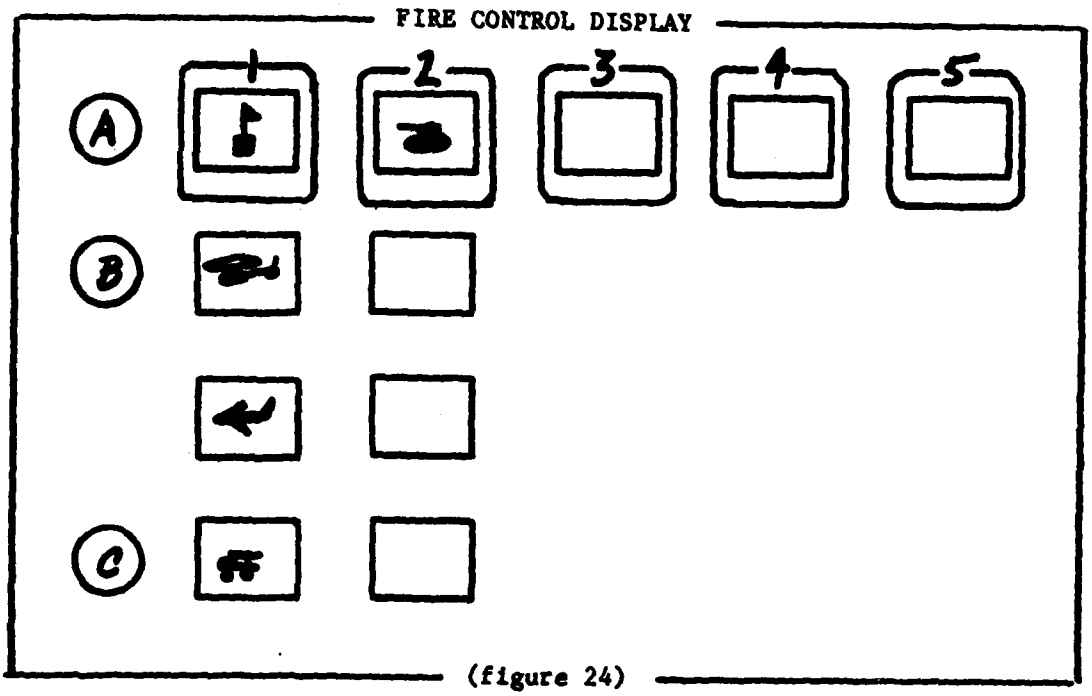
- One representing unit designation.
- One representing its parent unit.
- One representing its location.

- One representing its combat power.
- One representing its task organization.

If the information potentially displayable on these mandalas were explained in words--it would require the equivalent of 15 typed pages of script. An example of a display (although in black and white only) for the OPMS system is shown in figure 23.

Intelligence Array

We can collect all sort of data and display them to reflect events under our control. But in addition, we can design the display to doctrinally guide the actions of the user. As an example, figure 24 depicts a fire control display.



(figure 24)

KEY:

A. Line up targets in order of priority, left to right on top of display--show them graphically.

B. Line up appropriate target striking weapon systems in order of effectiveness, top to bottom--show graphically.

C. Show colored light change from green to yellow to red according to amount of ammunition or strike capability that remains.

A glance will now show the relative effectiveness of the pairings and the strike capability remaining by weapon system--that glance will convey much more than "raw data".

INFORMATION ENGINEERING

Armed with a useable information flow model, a new perception of information and meaning, an awareness of the relationships among information flow efficiency and effectiveness and the chain of command, delegation, mission orders, command climate, feedback and distortion--and using the information flow technologies developed by the Army led University of Louisville research team, it is now possible to move into an oganization and, with minimum disruption of the unit's "natural state", operate on the "health" of the unit's information flow. We can examine its information flow processes, diagnose problems, locate information flow bottlenecks and other pathologies, then prescribe accurate, do-able, understandable, relatively easy, common sense things to do to increase the capacity of the unit's information processing capability.

What this information processing intervention represents is a break-through, not by some consultant corporation, but by a new science, Information Engineering. It is an assault on the problems of a new "Age of Information" whose fallout will make the plot of actual force readiness drop even more sharply unless we can somehow get a better grip on the difficult business of turning information into action.

In order to achieve an increase in information processing capability through such efforts as information process analysis in units, we have to start developing IF expertise in our Army. What we don't need is a new school, or a new staff position, or a group of briefing teams released out onto the "workshop" circuit. We need simply to expand, to develop, to "grow up" more, a staff position we've already got--the "communications" officer. A new dimension must be added to what he does and to the curriculum that teaches him how to do it--information flow technology, Information Engineering. He needs an additional dimension of expertise that will enable him to diagnose and correct problems in information overload--in garrison, during training, and on the battlefield.

Along with the "commo officer" to provide the expertise and serve as the "concept carrier" for efficient and effective information flow, the Army needs an expanded C^3I doctrine--a doctrine that would incorporate "the transfer of meaning" as its central philosophy. And across our entire Army, for all its varied activities, we must expand our definition of "communications" to include the last critical determinant--man.

INCLOSURE 1

INFORMATION FLOW INVENTORY

1. Note to turn in cash collection sheet to Bn Mess Hall.
2. Computer print-out of unit equipment from Computerized Movement and Planning System (COMPASS).
3. AR on Assignment of Personnel with Handicapped Dependents.
4. Receipt for $19.60 for attendance of Lt & Mrs Greene at a battalion function.
5. CBR Officer Course certificate to be given to LT Lewis.
6. FM on organizational maintenance operations.
7. Draft EER for Mtr Sgt.
8. Forms, statements, and reports pertaining to theft of $100 bill.
9. Note from Bn, informing XO he would be appointed investigating officer for above.
10. Note to XO to round up references (FM's, SOPs, OPlans) for FTX.
11. Ltr from Bn: Buck-up performance of officers appointed as Report of Survey Officer. 3-page checklist attached.
12. Pencilled list of FTX Preparation Actions:
    07 Feb: Bde Chem Officer to check company CBR teams.
    07 Feb: Briefings for dependents on FTX.
    07 Feb: Bde practice convoy for FTX.
    11-13 Feb: Bde FTX.
    11-17 Feb: Bn FM radio update.
    15 Feb: FTX convoy briefings.
    19 Feb: FTX Advance Party depart.
    21 Feb: Submit FTX rail movement data.
    25 Feb: Bn wheeled convoy departs for FTX.
    28 Feb: Submit FTX air movement data.
    04 Mar: Bde Communications Exercise.
    07-13 Mar: FTX.
    20-21 Mar: Rail deployment, FTX return.
    22-25 Mar: Air deployment, FTX return.
    24-28 Mar: Wheel deployment, FTX return.
13. Note to put concertina around motor pool parking lot. Sister Bn has AGI.
14. DF from Bn: Staff Duty Officer roster.
15. DF from Bn: LT Lewis go for Officer Record Brief.
16. Bn SOP on reports.
17. EER for Mess Sgt.
18. Hand receipt for Mess equipment used to feed mortar section in the field.
19. Claim form against soldier who kicked window out of private car.
20. Ammo request for mortar training.
21. DF from Bn: Training notes on "lessons learned".
22. Ltr from member of unit who had PCS'd 3 months earlier.
23. Range request for mortar training.
24. Hand receipt for 1 folding cot.
25. Bar to reenlistment form for PVT in the unit.

26. DF from Bn: Complete OER support forms.
27. Article 15 Record of Proceedings on PFC who failed to go to field training.
28. Weekly training schedule.
29. Note to counsel Smith, Jones, and Harris on reenlistment.
30. Equipment Dispatch Annex to Bn Maintenance SOP.
31. Set of handbooks for "PEGASUS" CPX.
32. DF on suspension of Art 15 punishment for Specialist Hammond.
33. DF from Bn: Submit handwritten training schedule.
34. EER for SSG Moon.
35. Diagrams for combat loading of vehicles.
36. Separate ration authorization for PFC Richards.
37. Medical examination report on little finger of PFC Atkins, with note from Bn to complete Line of Duty investigation NLT 15 February.
38. 1st Platoon loading plans.
39. Ltr from Bn: Composition of FTX Advance Party.
40. List of junior NCOs to attend Bn Leader Development program.
41. Ltr from Div: TOW and DRAGON training.
42. DA Circular on SQT for FY 1980.
43. Ft Benning text: Plt Ldr Training Management Planning Book.
44. Training Circular on tank-mech infantry team.
45. Battalion ARTEP.
46. Ft Benning text: Infantry Co Cmdr's Handbook.
47. List of men absent from PT.
48. Schedule of re-enlistment interviews.
49. DF from Bn: Soldier of the Month.
50. DF from Bn: Motor Pool Police Responsibilities.
51. DF from Bn: Staff Duty NCO Roster.
52. DF from Bn: Regional Marksmanship Championships.
53. List of personnel requiring yellow fever shots.
54. DF from medic: Names of men due overweight weigh-in checks.
55. DF on individuals to attend remedial PT on Saturday.
56. DF for LT Greene to take annual medical exam.
57. DF from Bn: School quotas.
58. Sick slip for PVT Flores: with sprained ankle.
59. Sick slip for PVT Barder: with lung trouble.
60. Academic report on E-5 who completed BNCOC.
61. DF from Bn: Appointment of E-5/E-6 Promotion Board.
62. PT Scorecard for Specialist Jenkins.
63. DF listing authorized SD assignments.
64. DF listing marksmanship scores of all individuals in unit.
65. Request for school allocations.
66. Computer print-out of unit SQT Report.
67. Request for quota to Bus-driving school.
68. Notes from 1 meeting of "Things to Do" before FTX:
    1. Load sensitive items at Bldg 311.
    2. Put out emergency leave procedure to all troops.
    3. Submit Rear Detachment list to Bn NLT Monday, 1200.
    4. Leave extra keys for rear detachment.

5. Send 1 NCO and 2 men to railhead for loading.
6. Send troops to cold weather classes on 15 Feb.
7. Submit POV list to Bn Tuesday.
8. Advance party: take 1 CONEX (with rifle racks) per Co.
9. Send 2 men to Bn S2 for LRRP.
10. Submit report on Reports of Survey, prior to FTX.
11. Mark all individual duffle bags prior to FTX (Red).
12. XO check drive-trains of all vehicles.
13. Claims officer to brief troops Monday.
14. Bring enough trashbags for whole exercise.
15. Issue luminous tape for all troops.
16. Send drivers to Bn for Bn XO maintenance class, 1400.

INCLOSURE 2

INFORMATION FLOW AND DECISION-MAKING IN CRISES

RECEIVE - As Stress Increases:

- o Search for information is less thorough.
- o Receiving gets increased priority.
- o Incoming information becomes more confused, vague and limited.

SCREEN - As Stress Increases:

- o Importance of what is read, believed and retained increases.
- o Priority of screening increases.
- o Screening efforts which emphasize speed increases.

CIRCULATE - As Stress Increases:

- o Number of channels increases geometrically.
- o Speed of circulation takes precedence over accuracy.
- o Highest ranking message handler becomes focal point.
- o Channels are more open leading to contradictory messages.

LEARN - As Stress Increases:

- o The search for and identification of alternative solutions to problems decreases.
- o Ability to improvise and innovate decreases.
- o Set procedures are invoked.

MEMORY - As Stress Increases:

- o There will be a shift in communications from written to verbal.
- o Formal record keeping decreases.

ADJUST - As Stress Increases:

- o Number of channels used in adjusting increases.
- o Ad hoc channels for adjusting are established to cope with information input overload and distortion.
- o Autocratic control decreases unless based on expertise.
- o Personality attributes and relationships become salient.

TRANSLATE - As Stress Increases:

- o Ability to predict and control consequences of output decreases.
- o Coordination of outgoing messages decreases.

SEND - As Stress Increases:

- o Ambiguity of messages increases.
- o Output decreases in volume and quality.

DECIDE - As Stress Increases:

- o Number of decisions increase.
- o Number of deciders increase.
- o Situational decision-making increases.
- o Diffusion of decision-making increases.
- o New decision makers with relevant expertise will emerge.
- o Number of decision errors increase.
- o Decision-making becomes more rigid.
- o Decisions made more quickly.
- o Priority decisions made by highest rank present.

INCLOSURE 3

HIGH PERFORMING UNITS

Many times over the past two years, the Commanding General of TRADOC, General Starry, has highlighted the need for "high performance crews in well trained high performing units." He has called such units the greatest contributing factor to relative combat power. The relative value and relationships of these factors have been expressed as:

TECHNOLOGY = 3-5%
HIGH PERFORMANCE CREWS = 12-15%
HIGH PERFORMANCE CREWS IN HIGH PERFORMANCE UNITS = 25%

The performance differential between high performance and other units has been documented throughout history. Vivid historical examples of units in combat portray examples of unit performance far superior to performances of similar units. Examples like the 101 Airborne Division at the Battle of the Bulge and the British defeat of the Spanish Armada. There are more mundane examples of high performing systems such as athletic teams, successful corporations and symphony orchestras.

What is the nature of these high performing systems? How do we create them and how can we recognize them? Commanders responsible for unit performance need answers to these questions.

Many times a day commanders of Army units ask themselves, "Am I commanding in such a way as to achieve high performance in my unit?" They then answer themselves with a vague, ill-defined "feeling" that things are going right, or -- not so right, and then they change or don't change, accordingly. Or they may rely on traditional indicators such as AGI, ARTEP, SQT and USR results, performance rates such as AWOLs, Court Martial and Article 15s.

Countless studies of units have been conducted to try to define, for the commander, a way to systematically and continuously measure the effectiveness of his unit. These studies have been characterized by a pre-occupation with the component parts of a unit rather than the unit as a whole. The attention of investigators has been on problem finding and problem solving with respect to parts. How much of the richness of the unit, as a whole, AS IT IS, may be missed? Some studies have produced useful insights, but none have defined a valid effectiveness measure.

In a particularly good unit, soldiers FEEL something about the way their unit is operating. WHAT they feel is not as important for understanding the unit, as is the fact that they are feeling it together. General perceptions, therefore, may be more useful and valid

for answering the question, than detailed conclusions about the

component parts or functions of the unit.

To understand units, particularly high performing ones, we need richer, more vivid accounts of how the unit actually functions rather than descriptions of the behavior of indepedent and dependent variables. It is the mix and reinforcing quality of these variables that must be understood.

Few, if any commanders have been heard to say, "I can't really measure my effectiveness, therefore, I won't worry about it." On the contrary, commanders push for improved performance levels without a clear awareness of what the real performance levels are or even what levels are possible.

Perhaps the futility of standard research approaches should be recognized and an alternative approach investigated, one that looks at the "flavor" of a unit. One such approach would be to develop a comprehensive list of descriptors of the NATURE of a high performing system. (HPS) Descriptors of a high performing unit (viewed as a system) should have diagnostic and perhaps even prescriptive value. Armed with such a listing, the commander could better define his "feelings" about his unit and react accordingly.

When a group of soldiers operating together in a unit is performing its mission in a way that may be described as "excellent" or "outstanding", what events, characteristics or behavior can be observed in that unit? Though there is no absolute measure of "outstandingness", in a comparative sense, excellent or outstanding means doing significantly better than similar units with similar men and the same mission.

The indicators of high performing systems may provide for commanders and others a better understanding of "outstandingness" and a standard - a target to shoot at, thereby easing the problem of measuring and improving unit performance. Instead of asking himself, "Am I commanding in such a way as to improve my unit?", he may want to check his observations about his unit against the descriptive indicators. The indicators listed here are not the direct result of empirical research but represent "intuitive leaps". Some overlap and some may seem to contradict. The indicators fall into 5 categories.

1) The unit

2) The interaction between the soldiers and their HPS

3) The leadership

4) The "US" attitude

5) The interface between the soldier and his gear

THE UNIT

1) HPs WILL EXHIBIT A RHYTHM OF OPERATION THAT IS FELT BY ITS SOLDIERS AND EVIDENT TO OBSERVERS. PHRASES TO DESCRIBE THIS RHYTHM LIKE "THEY REALLY HAVE IT TOGETHER" OR "THEY CAN'T DO ANY THING WRONG" WILL BE COMMON. The general phenomenon to which these phrases refer is that improved operations are produced with substantially less effort than before the rhythm was achieved. Athletic teams commonly display this rhythm even if for short periods of time. Behind 24-0, the USC Trojans scored 55 points in 17 minutes in a 1974 football game. Infantry squads undergoing the Forced March-Live fire event in the ARTEP often display this rhythm.

2) THERE WILL BE A GREAT DEAL OF EXPERIMENTATION AND REHEARSAL IN A HPS. VARIOUS WAYS OF OPERATING WILL BE TRIED WITH ONLY TEMPORARY FIXATION ON "THE ONE BEST WAY TO DO IT."

3) THERE WILL BE A CONSIDERABLE AMOUNT OF SHIFTING AROUND OF VARIOUS MANUAL AND MENTAL ACTIVITIES WITHIN A HPS. NO ONE KIND OF BEHAVIOR WILL DOMINATE. HPSs continuously reevaluate their operational methods. They don't stagnate or rest on past performance. They are extremely innovative and creative.

4) A HPS WILL NOT HAVE A CLEAR OFF/ON CHARACTER. ITS SOLDIERS MAY REGARD IT AS ON WHEN IT SEEMS OFF TO OBSERVERS AND VICE VERSA.

5) SOLDIERS OF A HPS WILL ATTEMPT TO "ARRANGE THE ENVIRONMENT" WITHIN WHICH AN ACTIVITY IS GOING TO OCCUR. THINGS HAVE TO BE "JUST RIGHT." The importance of timing will be well understood.

6) THERE WILL BE A LOT OF UNOBSERVABLE ACTIVITY WITHIN A HPS AND ONLY THE MOST PROMINENT ACTIONS WILL BE EVIDENT. This indicator relates to 2 & 3. Internally HPS are characterized by continuous and frantic activity the purpose of which is to ensure that whatever the product of the unit may be, it is the best possible. This activity is low key to outsiders but very important to the soldiers of a HPS.

7) HPSs WILL EXCITE CURIOSITY ABOUT ITS HIDDEN ACTIVITY. THEY WILL DEVELOP PROTAGONISTS WHO WILL PLAY IMPORTANT ROLES IN THE UNIT'S INTERFACE WITH HIGHER AND ADJACENT UNITS. A HPS will develop a reputation (See #1) as a winner. Close association to that unit will develop among higher headquarters staff officers and possibly commanders. They will become personally involved in the HPS's well-being and champion the HPS at every opportunity.

8) FOR MOST SOLDIERS IN A HPS, THE OUTCOME OF AN EFFORT MAY NOT BE AS IMPORTANT TO THEM AS THE TASK ITSELF. TO THEM, THE VALUE OF THE TASK IS IN THE DOING OF IT.

9) WHEN A NEW SOLDIER JOINS A HPS AND AFTER BECOMING A CONTRIBUTOR, HE WILL THEN AT SOME LATER POINT "TURN PRO." In a HPS, newcomers will not automatically be accepted. They have to earn their stripes. There will always be a small disfunctional group composed of those who were not accepted.

10) SOLDIERS IN A HPS EXHIBIT REFLEX BEHAVIOR TO THE DEGREE THAT THEY LATER CANNOT ACCOUNT FOR HOW OR WHY THEY ACTED IN A PARTICULAR WAY.

11) UNSUSPECTED TALENTS WILL EMERGE IN SOLDIERS WHO BECOME PART OF A HPS. Informal leaders will emerge and be accepted by other soldiers of a HPS. Conflict between informal and the formal chain of command leaders will not be evident even though the informal leader may be dominant. Each soldier of a HPS is given much latitude in seeking and occupying the particular position for which he is best suited. This internal, informal arrangement of positions and functions may not be evident even to the higher chain of command.

THE INTERACTION BETWEEN THE SOLDIERS AND THEIR HPS

12) SOLDIERS OF A HPS APPARENTLY "LIVE, EAT, SLEEP, BREATHE, AND FIGHT ABOUT" THEIR UNIT. This perception on the part of observers is an important clue that the unit to which the soldiers belong is a HPS.

13) SOLDIERS OF A HPS ARE AESTHETICALLY MOTIVATED TO SEEK CONTINUED EXPERIENCES IN THE HPS. This kind of motivation will be relatively incomprehensible to observers and they may regard these soldiers as "weird". This indicator relates to #8.

14) SOLDIERS WILL FEEL "PEAK EXPERIENCES" IN THEIR UNIT AND WILL DEMONSTRATE UNUSUAL ENTHUSIASM.

15) PERFORMANCE BREAKTHROUGHS WILL OCCUR IN UNPLANNED WAYS. SOLDIERS WILL ACCOUNT FOR THE EVENT IN RELATIVELY NON-OPERATIONAL TERMS SUCH AS "WE FINALLY GOT IT ALL TOGETHER".

16) WHEN PERFORMANCE OF A HPS DECLINES, ITS SOLDIERS WILL BECOME GREATLY AGITATED AND UPSET. The consequences of failure will seem to observers to be greatly magnified and it will appear that the soldiers "take things too seriously".

17) SOLDIERS OF A HPS WILL TALK ABOUT AND DEVELOP SCENARIOS OF DESIRABLE STATES FOR THE HPS. A considerable amount of apparently meaningless behavior can be explained as attempts to live these scenarios. The function of all such attempts seems to be to prepare soldiers to participate in the unit's operation and to sustain them through its difficulties.

18) PASSAGE OF TIME WILL BE MEASURED BY UNIT ACTIVITIES AND

PERFORMANCE. Instead of saying "next month" soldiers will say "after the ARTEP" or "the week before the river crossing".

19) BOREDOM WILL TEND TO BE ABSENT.

20) SOCIAL AND OPERATIONAL ACTIVITIES IN A HPS WILL TEND TO BE COMBINED TO A MUCH GREATER EXTENT THAN IN NON-HPSs. Informal meetings will often occur at officers and NCO clubs. There will be a lot of "talking shop".

21) SOLDIERS IN A HPS WILL EXHIBIT A CONSCIOUSNESS OF THE HISTORY, TRADITION AND LORE OF THEIR UNIT. A "HALL OF FAME" PHENOMENON ASSOCIATED WITH ASSIGNMENT TO THE HPS WILL ARISE. They may not be expressed in the traditional sense. "History" may not mean what the unit did in World War II but rather what Cpl Ledbetter did on last weeks river crossing. The unit crest becomes important not because it represents a famous fighting unit but because it is a symbol common to soldiers who are sharing a satisfying, rewarding experience in the present. Myths will develop about recent historical soldiers of the unit.

THE LEADERSHIP

22) LEADERSHIP BY EXAMPLE WILL BE FOUND IN HPSs, SOLDIERS WILL LOOK AT THEIR LEADERS AS "PACESETTERS."

23) LEADERS IN HPSs WILL NOT BE LOOKED AT BY THE SOLDIERS AS GENERALISTS WHO NO LONGER ARE FULLY EXPERT IN THE BASIC FUNCTIONS OF THE UNIT. A LEADER'S INITIAL STATUS, INFLUENCE, CREDIBILITY AND PRESTIGE WILL COME FROM THE DEMONSTRATION OF EXPERTISE.

24) AFTER AN EXTENDED PERIOD, LEADERS OF HPSs WILL BE "PUT ON A PEDESTAL" AND WILL EMBODY THE MEANING OF THE OPERATIONS THAT THE HPS PERFORMS. A leader's personal charisma in a HPS is composed of two elements, his own personal style and "unit charisma" which he embodies as the units' symbol of excellence. Fantastic capabilities will be associated with the leaders of a HPS and failure to live up to them might be devastating. The "pacesetting" function is important to the soldiers as it reaffirms the leader's capabilities. Soldiers will be heard saying "The only guy that can do it better than I is the old man".

THE "US" ATTITUDE

The following observations deal with the cohesive nature of a HPS. A fraternal or "US" attitude is developed by its soldiers. In general, HPSs consider themselves "above" similar units to the extent that conventional restraints, rules and normal operating procedures are, to varying degrees, modified or disregarded. Outside influence is neither solicited nor welcomed. A HPS tends to be very "private" and protective of its soldiers and prerogatives. The spirit of "US" or "WE" trancends feelings of "ME" and "I" to the extent that soldiers say "WE" when they

mean "I".

25) THERE WILL ALWAYS BE DISCREPANCIES BETWEEN "WHAT THE BOOK SAYS" AND WHAT THE HPS ACTUALLY DOES. CIRCUMVENTION OF THE RULES TENDS TO BE OVERT AND NONAPOLOGETIC. This is a reflection of the competence and confidence within a HPS. The protagonist mentioned in #7 will assist in any difficulties that may arise as a result.

26) EXTERNAL CONTROL ON A HPS's OPERATIONS ARE VIEWED BY ITS SOLDIERS AS AT BEST IRRELEVANT AND AT WORSE AS POSITIVE IMPEDIMENTS TO PERFORMANCE.

27) HPSs WILL TEND TO EVOLVE VARIOUS SOPs FOR DEALING WITH HIGHER AND ADJACENT HEADQUARTERS AND TO LIMIT THIS FUNCTION TO "ADVANCE MEN" WHO ARE EXPERT IN THESE RELATIONSHIPS.

28) EFFORTS TO DICTATE PARTICULAR KINDS AND QUALITY OF OUTPUT OF A HPS WILL TEND TO DEPRESS MOTIVATION UNLESS THE RELATIONSHIP WITH HIGHER HEADQUARTERS IS VERY CAREFULLY AND EFFECTIVELY HANDLED.

29) INTERNAL UNIT OPERATIONAL NEEDS ARE THE CRITERIA USED BY SOLDIERS OF A HPS TO SEEK RELIEF FROM THE PRESSURES OF PARTICIPATION. EXTERNAL SCHEDULES FOR RELIEF AND BREAKS ARE REGARDED BY SOLDIERS AS INAPPROPRIATE. Relates to #8, 12 & 33.

30) REMARKS BY SOLDIERS TO OUTSIDERS ABOUT HOW AND WHY THE HPS OPERATES AS IT DOES WILL TEND TO BE IN TRITE GENERALITIES OR BY SHOWING RATHER THAN TELLING. SOLDIERS WILL OFTEN SAY, "THERE'S NO WAY I CAN EXPLAIN IT TO YOU".

31) A PRIVATE LANGUAGE AND SET OF SYMBOLS ARISE AMONG THE SOLDIERS OF A HPS FOR TALKING ABOUT ITS CONDUCT AND PROBLEMS. TO OUTSIDERS, IT MAY BE UNINTELLIGIBLE JARGON.

32) SOLDIERS IN A HPS DEVELOP A SET OF UNIT-SPECIFIC INDICATORS OF PERFORMANCE EMBODIES IN A HIGHLY PERSONALIZED CODING SYSTEM THAT MAY NOT RELATE TO OTHER SIMILAR UNITS. This private language facilities the rapid transmission of information and is a method of preventing information overload. Though its presence distinguishes HPSs from other units, its purpose is functional rather than affective.

33) HOURS OF WORK AND INTENSITIES OF EFFORT WILL BE DETERMINED BY THE IMPERATIVES OF A HPS's OPERATIONS RATHER THAN BY SUPERIOR HEADQUARTERS.

34) A SET OF EXPLICIT VALUES ABOUT WHAT THE UNIT DOES AND WHY IT DOES IT WILL ARISE. There will be much introspection and system evaluation covering all aspects of the HPSs operations. This will be continuous and is related to the indicator that expresses the divergence and variation in activities with little fixation on "the one best way".

35) THE MEANING OF SOLDIERS' BEHAVIOR AND ACTIVITY WILL BE A FUNCTION OF THE HPSs ACTIVITY RATHER THAN THE STANDARDS OF THE LARGER UNIT.

THE INTERFACE BETWEEN THE SOLDIER AND HIS GEAR

The second surprising phenomenon is the apparent interaction and preoccupation of soldiers in a HPS with the gear (tools, weapons, vehicles, radios, etc) they employ in the operations of the HPS. This special attachment of the soldiers to their gear should be one of the easier indicators to identify. This phenomenon will probably begin to occur at the early stages of high performance.

36) SOLDIERS WILL ADD TO AND ELABORATE UPON THEIR GEAR. THEY WILL INVENT A VARIETY OF HOMEMADE JIGS, PROPS, FIXTURES AND SIGNALLING DEVICES THAT FUNCTION TO IMPROVE THEIR RELATIONSHIP TO THEIR GEAR - MAKE THEM WORK BETTER AND LAST LONGER. Field expedients of unusual variety and effectiveness will be commonplace.

37) SOLDIERS MAINTENANCE ON THEIR GEAR IS FREQUENTLY CO-MINGLED WITH PERFORMANCE AND WILL NOT NECESSARILY BE A SEPARATE FUNCTION.

38) SOLDIERS OF A HPS WILL ASCRIBE HUMAN CHARACTERISTICS TO THEIR GEAR. MACHINES BECOME PEOPLE AND GET PERSONAL NICKNAMES. VARIOUS PIECES OF EQUIPMENT WILL BE ASSIGNED A PSYCHOLOGY ALL THEIR OWN TO WHICH THE SOLDIER WILL FEEL HE MUST RELATE.

39) SOLDIERS, THEREFORE, WILL DEVELOP PERSONAL RELATIONSHIPS BETWEEN THEMSELVES AND THEIR EQUIPMENT.

40) AS A RESULT, SEEMINGLY IMPOSSIBLE PERFORMANCES WILL BE CALLED FORTH FROM THE GEAR OF A HPS; PERFORMANCE NOT ENVISIONED BY ITS DESIGNERS. As an example, two tanks, one with the engine out, the other with the fire control system out, were hooked together to produce one operable system.

The foregoing indicators describe characteristics of HPS which will naturally evolve during the development of a HPS in a healthy organizational climate and with positive leadership. Attempts to artificially create these characteristics (e.g., "Everyone nickname your weapon") will probably be counterproductive. Further, presence of a few of these characteristics in isolation does not necessarily indicate achievement of High Performing System state. Rather, when a unit has achieved HPS quality, most of these characteristics will probably be observable.

INCLOSURE 4

ARMOR BATTALION RESEARCH HYPOTHESES

(H): High probability of confirmation on further research.
(M): Medium probability of confirmation on further research.
(L): Low probability of confirmation on further research.

1. (L) The less time the Battalion Commander devotes to the management of change and in the outputting of paperwork; the more effective the unit.

2. (H) - The more time and effort the Battalion Commander devotes to monitoring the supervising the unit and is involved in the decision making processes, the more effective the unit.

3. (M) - The more relevant and timely the information provided the Battalion Commander in his decider role, the more effective the unit.

4. (M) - The stronger the interpersonal relationship of the Battalion Commander, the Battalion S-3 and the Company Commander, the more effective the unit.

5. (M) - The more freely information flows between the Battalion Commander, the Battalion S-3 and the Company Commander, the more effective the unit.

6. (H) - The greater the Unit Commander's understanding of the information flow process, the more effective the unit.

7. (M) - The more unpopular/inadequate the leader, the greater the lag in processing information in the unit.

8. (M) - The more time a Company Commander spends monitoring, supervising and developing information to create action in the unit, the more effective the unit.

9. (M) - The less the Company Commander places emphasis on retrieving and assimilating information, possibly delegating to subordinate personnel, the more effective the unit.

10. (H) - The higher the clarity of mission among battalion command and staff leadership, the more effective the unit.

11. (H) - The fewer the distractors among battalion command and staff leadership, the more effective the unit.

12. (L) - Brigade staff may not be the best indicator of battalion effectivness.

13. (H) - The less time the Battalion Executive Officer spends in the management of training related information in the unit, the more effective the unit.

14. (H) - The more the Battalion Executive Officer devotes his attention to the management of logistic and administrative matters, the more effective the unit.

15. (M) - The more time the S-3 spends in "receiving" and "adjusting" processes rather than the output process, the more effective the unit.

16. (L) - The more the S-3 stresses "receiving" the more effective the unit.

17. (M) - The more the S-1 employs "circulating" and "adjusting" processes (thus actively reaching out to provide a service to subordinate units), the more effective the unit.

18. (M) - The more the Battalion Operations NCO concentrates his efforts in "sending", the more effective the unit.

19. (M) - The more involved the First Sergeant is in the training activities of the company, the more effective the unit.

20. (M) - The more the 1SG uses "circulating" processes (thus increasing pertinent information flow to company units), the more effective the unit.

21. (M) - The more the clerk in the S-3 section acts as the memory repository and information input gatherer for the Operations Officer, the more effective the unit.

22. (H) - The greater the knowledge of information flow processes among unit personnel, the more effective the unit.

23. (L) - The greater the adherance to traditional divisions of labor of battalion soldiers, the more effective the unit.

24. (H) - The greater the specialization of functions among unit components is based on Information Flow concept analysis, the more effective the unit.

25. (H) - The more efficient the sensory reading by the unit, the more effective the unit.

26. (H) - The higher the understanding of job in the context of the whole, the greater the efficiency and effectiveness of the unit.

27. (H) - The greater the effort extended in training trainers and battalion leadership personnel, the more effective the unit.

28. (H) - The more efficiently resources are distributed in the unit, the more effective the training.

29. (M) - The less written communications are relied upon to manage a unit, the more effective the unit.

30. (M) - The less the cost, lag and distortion in processing information within the battalion, the more effective the unit.

31. (M) - The shorter the time period information is processed and the less the distortion of that information; the more effective the unit.

32. (H) - The greater the movement of information-processing variables into a healthy, steady-state range; the more effective the unit.

33. (H) - The more meaningful the information used in developing directives to control the unit, the more effective the unit.

34. (H) - The greater the pressure to be evaluated favorably, the greater the distortion of evaluative information in less effective units.

Corollory: Also true of individuals - (cross-level).

35. (M) - The more meaningful the procedural change, the more effective the unit.

36. (H) - The greater the importance and meaning of information required in external/evaluation reports, the more accurate the evaluation of the unit.

Corollory: The more accurate the evaluation of units, the greater the potential for good management decisions at a higher level.

37. (L) - The less time a battalion spends on "looking good" in terms of information processes, the more effective the unit.

38. (H) - The greater the unit personnel's appreciation of and skills in information processing, the more effective the unit.

39. (M) - The more effective the screening and synthesis of information from external sources, the more effective the unit.

Corollory: The less distortion introduced into information from external sources, the more effective the unit.

40. (H) - The greater the rewards for providing meaningful, accurate, timely, and concise information, the more effective the unit.

41. (M) - The greater the ability to plan ahead, the more efficient the processing of information.